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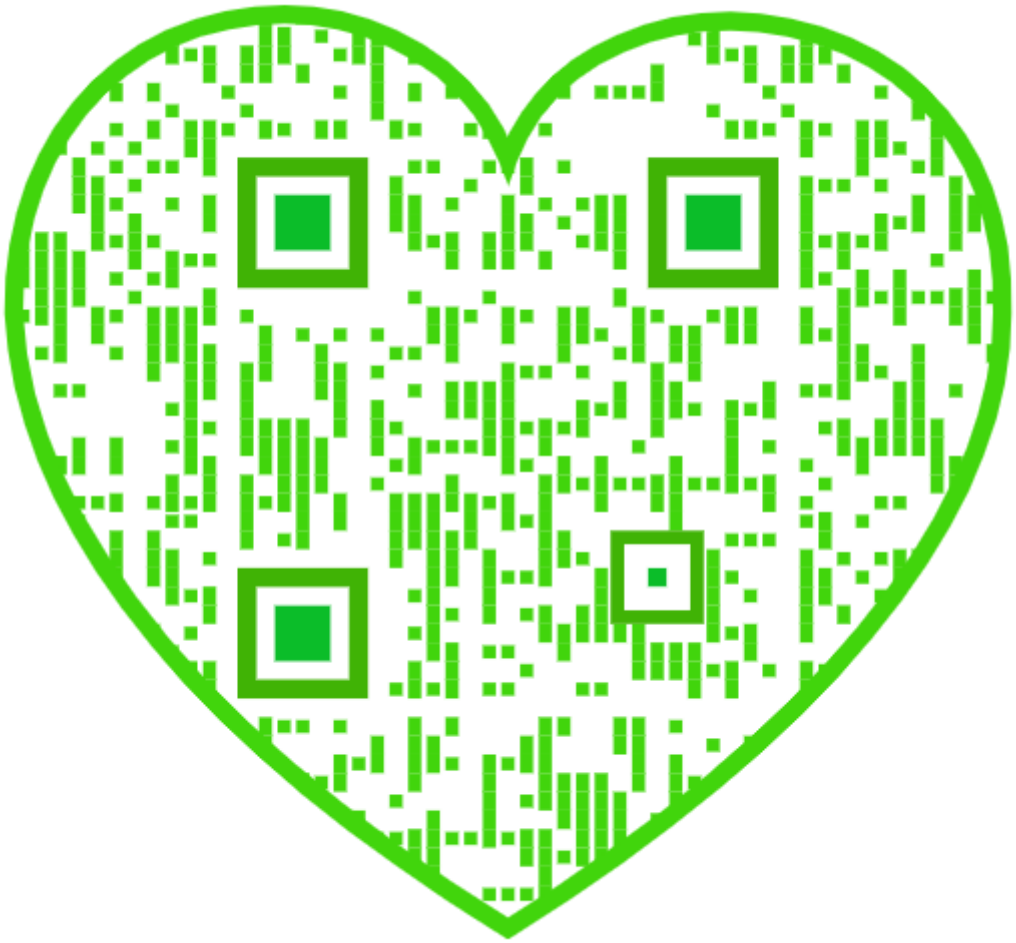

SCIENTIFIC AMERICAN

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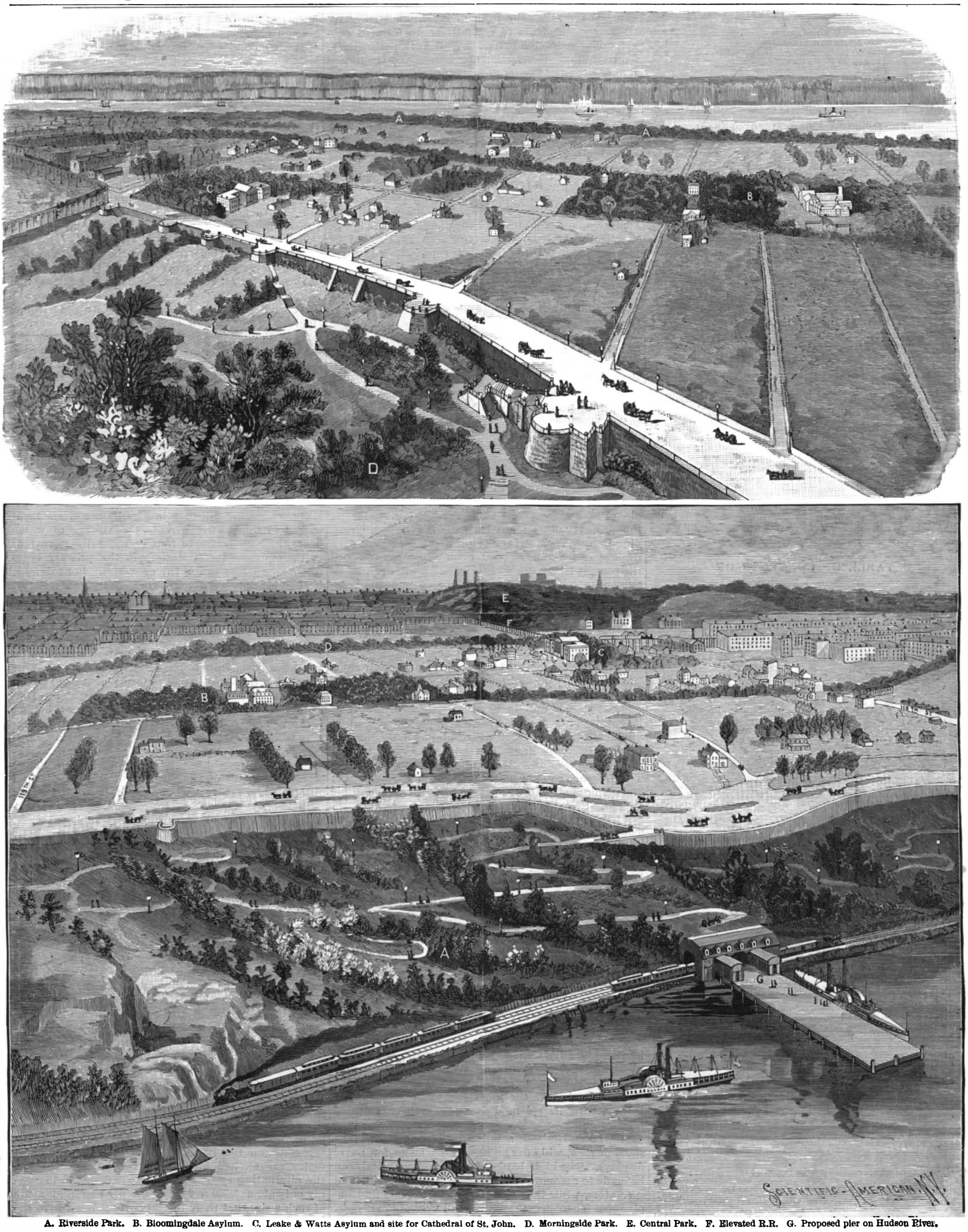

A. Riverside Park. B. Bloomingdale Asylum. C. Leake & Watts Asylum and site for Cathedral of St. John. D. Morningside Park. E. Central Park. F. Elevated R.R. G. Proposed pier on Hudson River.

PROPOSED SITE OF WORLD'S FAIR OF 1892 AT NEW YORK CITY.—[See page 8.]

ANNEX B

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THE WORLD'S FAIR OF 1892.

As our readers are aware, it is proposed to hold an international exhibition of the science and industries of all nations in 1892. The United States will be the scene of the exhibition, which is in commemoration of the discovery of America by Columbus in 1492. The city for the exhibition remains yet to be chosen. It must be determined by the action of Congress. The federal legislature will designate the locality, and in so doing will pledge the assistance and co-operation of the central government for the enterprise. Several prominent cities are making strenuous efforts to be selected, feeling that the fair will be a great benefit to the metropolis in which it will be held. These efforts have taken the form of conditional subscriptions, appointments of committees to forward congressional action, and have, in New York particularly, led to the definite selection of grounds, and the formation of a fund of five millions of dollars.

All Americans should have at heart the success of the exhibition as viewed from the national standpoint. The interests of a particular city are entirely a side issue. The fair is to be even more than national. The world of civilized nations is interested, and Congress should take this aspect of the case in evolving special legislation.

The impartial investigator would be guided in making a choice by considerations affecting the size of the assemblages, facility of transportation and of accommodation, and would regard the finances of the fair as practically assured. The city of New York would be pre-eminent in these respects. It represents a center of population, and literally a national metropolis, of over three millions of inhabitants.

It may be considered in this sense as second in size to London only of all the cities of the globe. Within the limits traced by a ten mile radius, the above population is included. But this is not all. Distance may be expressed in time. Within eight hours of New York by fast trains a number of great cities are situated. Rochester on the west and Boston on the east, come well within the above limit. Between them lie a number of centers of population, all of considerable importance. Going south, the cities of Philadelphia, Baltimore, and Washington would be contributors within the eight hour line. On this basis, it has been calculated that a home population of ten millions of people will be within eight hours of New York.

The foreign visitors will be most admirably provided for. It is but a few weeks since we illustrated examples of several new and magnificent ocean steamers, the property of as many transatlantic lines, all running to New York. If the exhibition is held here, fifty ships of equally fine character could be employed, and the present New York and European fleet, unequaled, and never to be equaled, will be the all-important factor in bringing visitors from abroad. Wherever the fair is held, the visitors must pass through the gates of the national metropolis. After the sea voyage they should find themselves at their goal, not a thousand miles or more distant.

As regards facility of transportation, the particular site selected is peculiarly good. It occupies a central position as referred to distances north and south. The approaches will radiate to northeast and south from its gates, and from each direction approximately equal numbers will come. This distribution will do much to prevent overcrowding. The site faces with a high bluff for three and a half miles upon the Hudson River. This frontage can be utilized to great effect. Wharves and anchorage facilities can be provided all along this stretch. Steamers from all parts of the Atlantic coast can bring their passengers directly to the fair grounds. They can lie at the foot of the grounds for a number of days and be used as hotels by their passengers, who thus can visit the fair with the maximum of comfort and convenience. Numerous elevators will be in operation from the wharves to the grounds. The world has never yet offered a site which presented the possibility of carrying out such an arrangement. There is no doubt if the fair is held on the grounds in question that steamers from Europe will carry out the programme suggested above, and that thousands will visit the fair without other home than the steamship that will transport them from shore to shore.

The site chosen for the exhibition in New York, views of which we present on our first page, is one of remarkable excellence. It occupies the whole of that elevated plateau known as Bloomingdale Heights, located just at one side of the center of the city, convenient and accessible from all points. On the west it fronts the Hudson River and on the east overlooks the Central Park, and the great city plain at the north thereof, with its splendid dwellings and concentrated population.

The noble Hudson, a mile in width and without shoal or rock, will offer an unequaled stage for naval displays. The high banks of the chosen grounds can be made to accommodate an assemblage of a million of spectators, while the fleets of the world would find ample room for maneuvers within full view of the people. As a minor feature the straightness of the river would favor the operations of trains of spectators, who could follow aquatic races and marine contests of every description.

The subject of money to carry out adequately the ends of the fair, and to enable America to present a greater exhibition than the world has yet seen, need hardly be considered. The wealth of New York, the character of the subscribers to the guarantee fund, and their ability to double or treble the subscriptions, are beyond all question. No city can offer a more satisfactory financial basis than that already guaranteed by New York.

THE INCANDESCENT LIGHT CONTROVERSY.

The controversy now in progress between the promoters of the rival systems of incandescent lighting, though some will think of doubtful expediency, so far as the companies are concerned, admirably serves to acquaint a public now grown timorous, with the detail of operation and with the nature of the precautions which, if employed, would render both systems entirely safe, at least to the user.

With perceptions sharpened by constant investigation, the rival champions have each in turn pointed out the defects of the other's system of lighting—defects which, because of the reticence of the companies, have, till now, only been surmised by the public.

It is the purpose of this article to examine these, as they have been pointed out; inquiring as to the mischief that might come, and describing the steps which the studies of practical electricians show to be necessary for their correction.

The alternating current system, the attack on which led to the present controversy, is used very generally on both sides of the water for incandescent as well as for arc lighting; its chief recommendation, the power it possesses to light extensive districts from a single station. In an arc light circuit the current reaches the lamps directly from the conductors, the voltage varying, according to requirement, from 1,200 to 2,000. In the incandescent system this high voltage is maintained in the street circuit, but, by the interposition of converters or transformers, located in or near each building, a secondary current of scarcely more than fifty volts is produced. This is suitable for operating a number of lamps, each equal to a full working five-foot gas burner of 16 candle power. The transformer is made up of two separately wound and insulated coils, one of thin wire connected to the street mains and the other of thick wire connected to the wires of the building to be lighted; currents sent through the coil of thin wire induce in the near-by coil of thick wire currents, the voltage of which bears the same ratio to that of the primary current as the number of convolutions in the primary bears to the secondary coil of the converter. For example, if the electromotive force of the primary or street current is 500 volts, and the electromotive force of the secondary current is required to be 50 volts, the primary coil will require ten times as many convolutions as the secondary. The promoters of this system say that it is an easy matter to make the insulation between the two already separated coils effective and to prevent the current in the primary wire from penetrating it. On the other hand, their rivals say that no system of incandescence which has a high tension current behind it can be rendered absolutely safe, that breaks or leakages will come, because the mechanisms of man, however ingenious, are never perfect, and human watchfulness and foresight not to be depended upon. They instance the case of the employe of the Manhattan Electric Light Company who got his death shock while carrying a portable incandescent light in the engine room of the station, a lamp, be it said, supposed to be protected from the main current by a converter. There would seem to have been a break in the insulation of the wire, which his hand must have rubbed against, his face perhaps touching a steam pipe, thus forming a ground. The station men say that only 120 volts were on the circuit, but as this would not destroy life, it is evident that the high-pressure alternating current must have reached the wire, and, passing through his body, got to the ground through the steam pipe.

This, however, happened within a station, and, it is claimed, cannot be construed as an argument against the safety of the system, any more than the death of a man who should fall against a fly-wheel could be used against steam engines. The alternating current people say, and truthfully, it would seem, that the record does not furnish proof of a single case of death among the thousands who have been using the system, where applied to incandescent lamps.

The continuous low tension system is that used in the circuits of Mr. Edison. Here the voltage on the street circuit, varying between 100 and 200, even the higher pressure not in the least dangerous to life, is the same on the house circuit. All underground mains are meshed into one network, and while in the alternating system the wires are designed to supply only about 1,500 to 2,000 lights per pair, and made of such a size that there is scarcely any decrease in the intensity of the lights at the further end, even when the demand for current is excessive the low tension

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system at times calls for an enormous electrical energy, the pressure being far greater nearest the station than away from it. At times, when the switch is worked to put out the lights in a certain district, an arc of blue flame is formed which must be blown out. This charge, made by a rival company, though true, is misleading, because the arc is harmless, never known to do any harm. The charge is made against the Edison system that it is subject to leakage, which at times leads to fire. But it does not and cannot take life, while leakage from the alternating street mains can take life as well as start fires.

As will be seen, both systems have striking advantages, and to all appearance are fairly safe. Disinterested electricians, however, insist that, to be rendered incapable of harm, where high tension currents are permitted in the streets, whether overhead or underground, every wire entering a house should be provided with a cut-out of lead or its alloy. It is a simple and inexpensive precaution by which a wire, however dangerously environed it may be, cannot transmit a high tension current beyond a certain point. Copper fuses at about 2,000° F., but lead at 608°, and its alloy at about 375°, and thus a strip of lead, joining the house system with the outside current would melt and break off all connection, should a vagrant current of high intensity essay to pass.

"EXPERIMENTAL SCIENCE."

This new book, by Mr. G. M. Hopkins, has proved to be very popular, and the demand for it is great.

It seems to meet the wants exactly of those who desire to obtain a knowledge of physics by means of actual experiment. It is profusely illustrated with novel representations of easily made devices, the construction of which can hardly fail to impart both skill and information to the learner.

The Normal Exponent says: "This is a magnificent work of 740 pages and 680 illustrations. We are especially interested in the character of the work in this book. We have been laboring in this field for years, and hope the popularity of science will be so effective that the commonest common school teachers will find that the most important truths of natural science may be easily taught by experiment in his school with apparatus which he and his pupils can themselves devise. This splendid volume will aid in this work immensely. We therefore commend it most heartily to all teachers, especially to our pupils who have already attained some success in this direction."

The Electrical World says: "Mr. Hopkins has produced a most interesting volume. We can readily imagine the delight with which any boy of a scientific turn of mind will study its pages and repeat the novel experiments described and illustrated. Scientific textbooks for the young are apt to take on an unattractive and even repellent shape, but this is one whose every page is an invitation to the joys of physical investigations. And the book is one, too, that will charm a great many persons far beyond childhood. There are not many general readers who care to bother with abstruse science after the educational period of youth; but the man must be dull, indeed, to the scientific and inventive progress of the age who cannot derive genuine pleasure and benefit from a perusal of these well-written and instructive pages, which put the student fairly abreast of the latest achievements in modern physics. The electrical chapters of the book are notably good, and the practical instructions given for building simple electrical machinery may be safely carried out by those, not a few, who like to make their own apparatus."

The following is from *The Engineering and Mining Journal:* "The author has avoided repeating the hackneyed illustrations which have been passed from one book to another so long, and instead offers a set of experiments which are largely of a novel character and very striking, particularly in the numerous paradoxes described, which are made so prominent a feature. The apparatus described, which is nearly always illustrated by the engravings, is mostly of a simple and inexpensive character, and is usually such as can either be improvised from articles in common use or can be made by any one having a fair mechanical aptitude and the proper tools. All of the apparatus mentioned has been personally tested and used by the author.

"The text consists of plain language, with as few technical terms as possible. The 672 cuts are nearly all from well selected original drawings, and help to explain the text and assist in preparing the apparatus described."

The English Mechanic and World of Science says: All teachers of science are aware that real knowledge is acquired best by the student making experiments for himself, and any one who points out how those experiments may be easily made is doing excellent work. For this reason we commend to the attention of all interested in the spread of knowledge the work by Mr. Hopkins, which deals with 'elementary and practical physics,' and which should be found in every library."

Nature (London) says: "The subject of experimental physics is here set forth in a manner calculated to afford to the student, the artisan, and the mechanic a ready and enjoyable method of acquiring a knowledge of this fascinating subject. Although the popular style adopted by the author perhaps makes the book better suited to the general reader than to the student, it may safely be said that all classes of readers will find much to interest them. All the subjects usually included in the comprehensive term 'physics' are discussed, and in addition photography, microscopy, and lantern manipulation. By carefully performing each experiment at the time of writing the description, the author guarantees certain success if his instructions are followed. There is an excellent chapter on 'mechanical operations,' containing many valuable hints on glass working, simple apparatus for laboratory use, soldering, and moulding. Mathematical expressions are almost entirely excluded.

"The book is chiefly remarkable for its hundreds of excellent illustrations, very few of which are diagramatic. Many of them, like a considerable portion of the text, have already appeared in the SCIENTIFIC AMERICAN, which is alone sufficient guarantee of their quality. Some of the latest inventions, including Edison's new phonograph, are described and illustrated."

Education by the Touch Alphabet.

Laura Bridgeman, the celebrated blind deaf mute, who gained such notoriety for the wonderful gift she possessed of acquiring knowledge through her only two faculties, and whose death was so much lamented in the scientific world a short time ago, has a youthful and very worthy successor in Miss Helen A. Keller, who is at present an inmate of the Perkins Institute for the Blind in Boston. She was deprived of her sight and hearing at the age of eighteen months. At the age of six, being deaf, dumb, and blind, she was put under the charge of Miss Annie M. Sullivan, who undertook to instruct her in the touch alphabet, and so eager was her pupil for knowledge, and so quick of perception, that she now is able to read and write with perfect facility.

It will be a matter of the profoundest interest to watch the development of human nature uninfluenced by the usual surroundings of life, and to watch the soul expand and grow by its own virility. No better insight into the character of this poor unfortunate is afforded than by a letter that she wrote to a gentleman who sent her a mastiff puppy as a present. He did not have long to wait for his reward in the receipt of the letter printed below, which is taken from the *Forest and Stream*, to which we are indebted for it. Its purity of diction and correctness of style is quite remarkable for a child of only nine years, especially when it is remembered that practically all her knowledge has been imparted by sense of touch. The letter, which was written in pencil in clear, distinct, round characters, is as follows:

SOUTH BOSTON, MASS., Nov. 20, 1889.

MY DEAR MR. ——: I have just received a letter from my mother, telling me that the beautiful mastiff puppy you sent me had reached Tuscumbia safely. I thank you very much for the nice gift. I am very sorry that I was not at home to welcome her. But my mother and my baby sister will be very kind to her while her mistress is away. I hope she is not lonely and unhappy. I think puppies can feel very homesick as well as little girls. I should like to call her Lioness for your dog. May I? I hope she will be very faithful, and brave, too.

I am studying in Boston with my dear teacher. I learn a great many new and wonderful things. I study about the earth and the animals, and I like arithmetic exceedingly. I learn many new words, too. Exceedingly is one that I learned yesterday. When I see Lioness I will tell her many things which will surprise her greatly. I think she will laugh when I tell her that she is a vertebrate, a mammal, a quadruped, and I shall be very sorry to tell her that she belongs to the order Carnivora. I study French, too. When I talk French to Lioness I will call her "Mon beau chien." Please tell Lion that I will take good care of Lioness. I shall be happy to have a letter from you when you like to write to me. From your loving little friend,

HELEN A. KELLER.

P. S.—I am staying at the Institute for the Blind.

H. A. K.

Education in Germany.

Education, says Consul-General Mueller, remains, as it always has been, an important factor in this country's policies. The new spirit to get as much knowledge as possible of the wants of the outside world continues, languages are still being learned and consuls and young men fitted for trade with other people. An idea of the thoroughness of a German education may be gained from a few facts which I read somewhere a few days ago. A candidate for engineer honors must first take a full scientific course up to and through a gymnasium, a kind of high school. At eighteen or twenty he begins his special technical studies. If he expects to be an architect or civil engineer, he goes two years to a technical high school at Berlin, Hanover, or Aix-la-Chapelle, after which he goes under an examination in science, mathematics, and building construction. Then follow two years more and another examination. If successful, the candidate becomes a government assistant engineer or assistant architect, and spends, without salary, a year in or on some government work. Then he is again examined. He must work out an original design at home, and one under the eye of the examiner, consulting no books of reference. If successful, he goes up and gets the title of government engineer.

Mechanical engineers have a different course. They go into an engineer's works for a year after leaving the high school, then they go two years to the technical high school, go through the preliminary examination, have two more years of hard study and practice and examination, two more years' practice, a year in which to prepare for final examination—eight years in all. At the end of this probation the candidate is employed and gets about $2 or $3 a day. After five years' labor he may get a permanent position. If skillful, however, and talented, he goes up and up, not by favor, but merit, and all in old age retire on a pension.

GERMAN EMIGRATION.

Of the persons emigrating from Germany to the United States, nine hundred out of every thousand are fitted to enter the various walks of active American life. Few emigrants—less than 15 per cent—are under ten years, 65 per cent are between twenty and fifty, but by far the larger part nearer twenty. The emigrants are, as a rule, strong, healthy, well trained, and intelligent. The thing they lack most is a knowledge of the English language. They have a good education, and one which has specially fitted them for that branch of business or labor in which they usually continue when they go to the United States.

Of those emigrating, factory operatives constitute 25 per cent, day laborers 12 per cent, small farmers 25 per cent, commercial men 10 per cent, skilled laborers, including professional men, 12 per cent, miners 6 per cent, and 10 per cent with no definite trade or occupation make up every hundred that leave German ports for the United States. No artisans or tradesmen go to the United States except to stay there. Emigrants go out to better their condition and make the best possible use of their time and strength. Not one in a dozen goes to the United States with any other idea. With the Germans their going is a voluntary act, a free choice. They know well just what they are doing, what to expect. They know before going, for they have been told that they must work, and they are willing to, and do so. No golden visions haunt their healthy sleep, nor do they have day dreams of fortunes made by doing nothing. They know that a competency in America, a living better than the one enjoyed in Germany, is to be purchased by hard labor. And they know also, for it has become a proverb here, that they must do almost twice the amount of work in a day in America as they have had exacted from them here. The land where "time is money" is known to them by letters and newspapers.

On the whole, German immigrants were always, are now, and always will be, so long as they preserve their race characteristics, a desirable class. They are, as a rule, honest, healthy, thrifty, intelligent, and of good habits. In an immigrant, what more to be desired? They always were and are to-day good citizens. Their faults they have in common with other men. Being intelligent, they naturally prefer the United States to all other countries; educated, they know a good deal of its history, its tendencies, and what it offers. If some have gone southward to the lower half of the continent, it was because efforts were made to direct the stream from the United States. The emigrant of to-day looks upon the United States as no El Dorado, but as the best country under heaven for a man or family willing to work, and Germans are workers.—*Jacob Mueller, Consul-General, Report to State Department.*

A Cure for Diphtheria.

The following remedy is said to be the best known, at least it is worth trying, for physicians seem powerless to cope with the disease successfully. At the first indication of diphtheria in the throat of a child make the room close; then take a tin cup and pour into it a quantity of tar and turpentine, equal parts. Then hold the cup over a fire so as to fill the room with fumes. The little patient, on inhaling the fumes, will cough up and spit out all the membranous matter, and the diphtheria will pass off. The fumes of the tar and turpentine loosen the matter in the throat, and thus afford the relief that has baffled the skill of physicians.

A Superb Christmas Publication.

The publishers of the *Montreal Daily Star* have issued a Christmas number which is hardly surpassed in beauty, quantity, or quality by their London contemporaries *The Graphic* or *Illustrated News.* It embraces two superbly colored pictures of flowers, several photo-engravings of Canada's principal cities, besides a number of full page engravings of some of the celebrated modern artists' best paintings. We congratulate our Canadian neighbors on their ability to produce such a beautiful Christmas number.

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THE PARIS EXPOSITION MEDAL.

The medal herewith illustrated, and which was struck off for distribution among the exhibitors who received awards, was designed by Mr. Louis Bottée. The competition was opened last May. It was not the only object of competition, which comprised also the engraving of a commemorative medal to be presented to the organizers, and which was designed by Mr. Daniel Dupuis. The conditions imposed by the circular were that within two months of the awarding of the prize the designers were to deposit at the mint the moulds and necessary paraphernalia for manufacturing the medals. The examination took place July 17. Mr. Bottée was awarded a prize of 8,000 francs, and the same amount was given Mr. Dupuis.

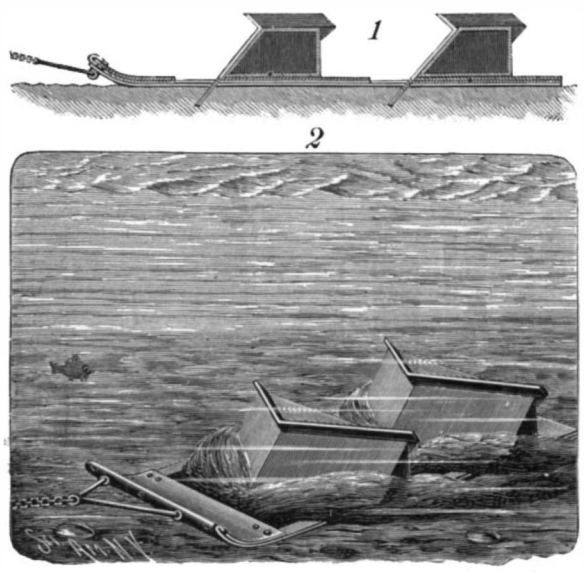
Like most of the designs presented by the fourteen competitors, Mr. Bottée's was antique in character. But the artist has skillfully given the composition a modern flavor. In the models and the arrangement of the draperies in particular, much taste is shown.

MEDAL OF THE PARIS EXPOSITION.

The obverse represents two figures: A superb figure representing Labor, seated on an anvil, in the act of being crowned by Minerva, who is seated near by with a bronze helmet on her head and wearing a collar that is decorated with the head of Medusa. As Minerva leans against the tree of peace, she extends the laurel in her right hand to the young man, who in return points out the Champ de Mars. The earth disappears in a halo of glory from a setting sun. The reverse presents a very simple and very beautiful composition. Renown, with her wings extended, encircles the calm and mighty crest of the republic. By means of the long trumpet she proclaims to the four corners of heaven the names of those who have been awarded prizes. As each exhibitor can only receive one bronze medal, Mr. Bottée conceived the happy idea of placing a tablet under the feet of Renown for the name of the recipient.—*L'Illustration.*

AN IMPROVED DREDGING SCRAPER.

A submarine plow, to remove obstructions and accumulations from the channels of rivers, etc., by being drawn over the bed of the watercourse to loosen the deposit so that it may be washed away by the current, is illustrated herewith, and has been patented by Mr. Joseph C. Coult, of Crockett, Tex. Fig. 1 shows a central vertical section of this improved plow, Fig. 2 being a view in perspective of the plow in operation, as it is drawn along by a drag-chain or cable from a steamboat or by other means. The beam of the plow consists of a platform or bed, preferably of boiler iron, made fast to bars of metal along either side, this bed



COULT'S DREDGING SCRAPER.

or beam resting on top of the deposit to be loosened, and its front end being bent up so that it will not dig into the sand while being drawn along. In one or more openings in this bed a plowshare is fastened, set at an angle, preferably of about forty-five degrees, and having a mouldboard shaped to deliver the debris at or beyond the two sides of the plow, each mouldboard having an overhanging front ledge to stiffen it and aid in directing the discharge of the matter raised by the plow.

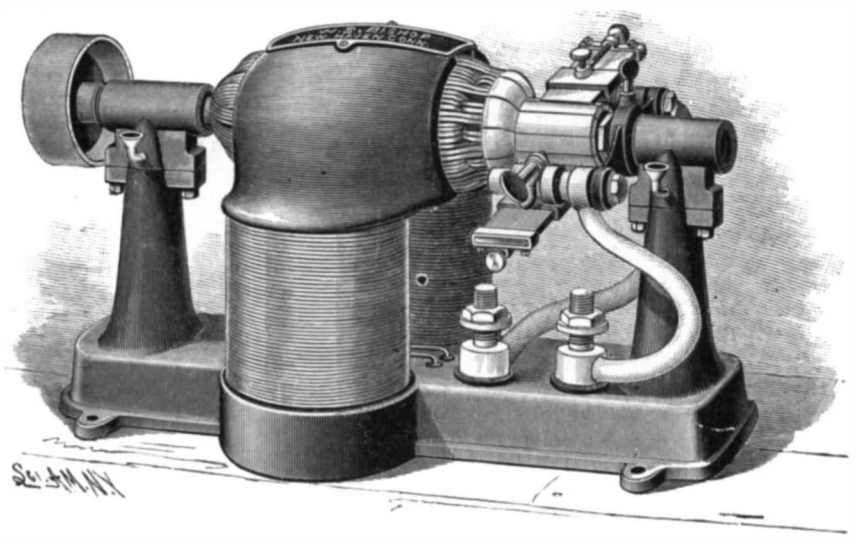
ON December 10, a forty-ton flywheel at the Chesapeake Nail Works, Harrisburg, Pa., burst and injured about a dozen of the three hundred persons employed in the establishment, who were either struck by flying fragments or caught in the *debris*. The building was badly wrecked.

NEW PLATING DYNAMO.

We illustrate a new dynamo for electro-plating, which has recently been perfected by W. S. Bishop, of 958 Grand Avenue, New Haven, Conn. In design it is symmetrical and compact. Mechanically, it is perfect in all its details. The pole pieces of the field magnet and the seats of the bronze journal boxes are bored at one operation, to secure perfect alignment of the armature shaft. The boxes are arranged to supply oil automatically to the bearings. The commutator is made of pure copper and provided with improved connections for the wires of the armature. The brushes are furnished with a screw adjustment, which is an important improvement.

The armature and field magnet are so proportioned as to enable the machine to deliver a large current without sparking at the brushes. The efficiency of the machine is very high, in consequence of its superior construction and perfect proportions.

Although the machine illustrated is a small one, occupying a floor space of only 13x22 inches, it will deliver a 140 ampere current with a pressure of 5 volts when running at a speed of 1,400 revolutions per minute. It will easily run a 400 gallon nickel solution or a 200 gallon brass solution. Its weight is 175 pounds. The pulley on the armature is 4 inches in diameter and 2½ inch face. These figures show a marked improvement over other machines of the same size and weight.



THE BISHOP PLATING DYNAMO.

THE NATIONAL SURFACE GUARD FOR RAILROADS.

Where an ordinary road crosses a railroad track at grade, much difficulty has been experienced in securing the exclusion of cattle from the track. However carefully fenced the railroad may be, cattle can obtain access to the tracks at any crossing. We illustrate a device designed to overcome this trouble. It consists of a species of grating that is laid between the rails. It is so constructed as to afford no footing to cattle. It has been found to operate as an effectual barrier, and is as efficient as any fence.

A series of bars of thin iron or steel are placed upon their edges parallel with the rails. They are notched into cross pieces, or are otherwise secured on their edges, so as to prevent lateral displacement. In order to avoid accident, they are spaced so closely that an animal cannot get its foot caught between them. But as this last condition would tend to impair their usefulness, they are made of unequal height. It is found by experience that nothing will induce cattle to trust themselves upon such a surface.

These pieces thus spaced and arranged may be carried upon the regular sleepers. But the perfected plan as shown in the cut provides for the use of two special sleepers considerably longer than the ordinary ones. On these the strips are secured. To make the surface still more deterrent, the bearing sleepers may be notched for the reception of the rail, so as to have their upper surface higher than that of the other intervening sleepers. When this is done the element of a springing surface is introduced. This adds to the insecure feeling experienced by any animals attempting to walk over it. The long sleepers are also used for attaching posts for the short section of side fence shown. This feature causes the fence to set well back from the road, so that it cannot interfere with the rolling stock in any way. It will be seen that the whole arrangement solves a rather difficult problem most effectually. The guard proper can be put in position in half an hour. It is made, as shown in the cut, in three sections, or if desired will be supplied in four, the center one being subdivided into two equal lateral panels. The last-named type of guard is held in place by hooks catching under the rails, and admits of quick placing or removal.

An improved thimble is used, which renders the bars perfectly secure from being torn up by dragging irons or brake beams.

It is now in use on over one hundred roads in North America, and is said to have been introduced in Australia. It has been indorsed by several conventions of railroad men, and to a certain extent may be included among the appliances of standard practice.

It is protected by seven patents, owned by the National Surface Guard Company, of 234 South Clark Street, Chicago, Ill. This company supplies the complete guard ready for immediate application.

THE NATIONAL SURFACE GUARD FOR RAILROADS.

The English and American Patent Systems.

The following comparisons of results of the working of the American and British patent systems have been circulated by the Inventors' Institute: Cost of patent—British, £154; American, £7 10s. Duration—British, 14 years; American, 17 years. Number of applications in 1887—British, 18,051; American, 35,613. Number of patents granted—British, 9,410; American, 20,429. Income of Patent Office—British, £124,279 7s. 9d.; American, £228,902; expenditure of Patent Office—British, £81,577 5s. 4d.; American, £198,892. Surplus (applied to the revenue of the country)—British, £42,702 2s. 5d.; American (added to patent fund), £30,010. Patent fund—British, none; American, £651,498.

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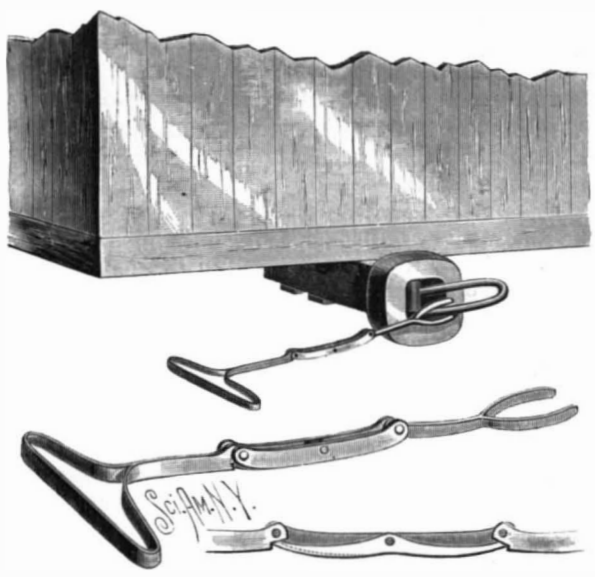
A HAND LIFTER FOR COUPLING LINKS.

A device which can be folded up and carried in the pocket, by means of which the coupling links of railroad cars may be elevated or otherwise moved, to enter an opposing drawhead, without the necessity of the operator standing or going between the cars, is illustrated herewith, and has been patented by Mr. Frank



GROVE'S LINK LIFTER.

G. Grove, of Luray, Va. The device is made in three bar-like sections, pivoted together, the central section having a spring which acts upon the shoulders of the two outer sections in a similar manner to the action of the spring of a knife handle upon its blades. The handle section has a head extending at a right angle beyond each side of the shank, and the grip section has an outer forked or bifurcated extremity, adapted to readily engage the link, giving a firm hold by slightly turning or twisting it, whereupon the operator, standing a considerable distance from the drawhead, may conveniently elevate, depress, or otherwise manipulate the link, as occasion may demand.

BROOKLYN'S TRIUMPHAL ARCH.*

The rage for erecting granite shafts and surmounting them with the bronze figure of a Union soldier seems to have passed away.

In some of our Western and Eastern cities, beautiful monuments have been erected in commemoration of their brave dead.

One of the most conspicuous and beautiful of these monuments is to be the memorial arch now in course of construction on the Plaza, at the west entrance to Brooklyn's, N. Y., beautiful Prospect Park.

The corner stone of this monumental arch was laid with appropriate ceremonies about six weeks ago. After waiting a sufficient time to allow the concrete foundations of the abutments to set, work was begun upon the superstructure.

The structure is to be of light granite, and will be eighty feet long, seventy-one feet high, and forty-five feet wide. Massive pedestals are to be raised on each side of the abutments, and are to be surmounted by bronze groups of colossal size. On the inner and outer faces of the abutments are to be attached bronze bass-relief figures emblematic of Victory, with the inscription "To the defenders of the Union, 1861-1865."

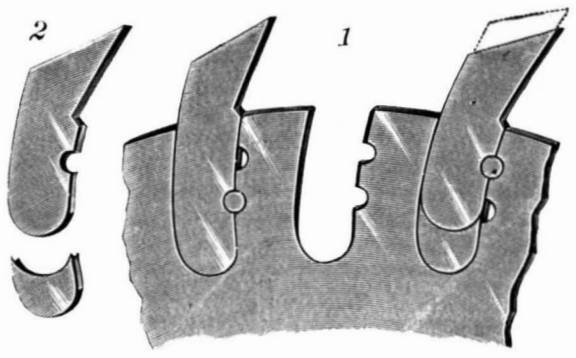
On the other side are to be carved on stone tablets the coat of arms of the United States and the State of New York. Above the main cornice will be wreaths within which are to be carved the names of the battles in which Brooklyn's men engaged.

The top, which is to be used as a point of observation, is reached by stairs located in each abutment, and these also communicate with a room over the arch, which is to be used as a museum for the exhibition of war relics.

* For the engraving of this arch we are indebted to the *Engineering News*.

AN IMPROVED SAW.

An invention providing for the readjustment or reprojection of worn-down insertible saw teeth, by inserting filling pieces or equivalent supporting devices behind the reprojected and resharpened worn teeth, is illustrated herewith, and has been patented by Mr. Benjamin F. Day. Fig. 1 is a side elevation of a portion of a circular saw with such a tooth applied, and Fig. 2 shows an insertible tooth with the filling block employed therewith. The tooth recesses in the saw plate have tongues in their longitudinal edges corresponding with grooves in the edges of the insertible teeth, the teeth being held in place by rivets in the usual way. A supplemental rivet seat is, however, supplied, forming a circular opening, partly in the saw plate and partly in the tooth, in which a rivet can



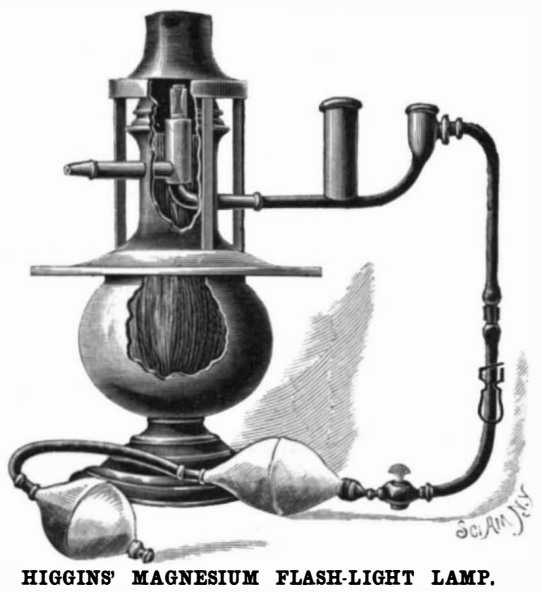
DAY'S SAW.

be secured to hold the tooth in projected position. The filling block to be inserted in the rear of the tooth has grooved edges to conform to the lateral tongues of the recess, to the basic portion of which it is specifically conformed, to constitute in effect a prolongation of the tooth.

For further particulars with reference to this invention address Mr. William Atkinson, No. 316 Columbia Avenue, Philadelphia, Pa.

AN IMPROVED FLASH-LIGHT LAMP.

The accompanying illustration represents a lamp fitted with apparatus whereby a charge of magnesium



HIGGINS' MAGNESIUM FLASH-LIGHT LAMP.

powder may be projected through the igniting flame, and the blast may be varied according to the light required. The invention has been patented by Dr. John J. Higgins. The lamp, as shown, is designed to burn alcohol or be supplied with gas, and the upper end of the wick tube is closed by a perforated annular cap, in the center of which is inserted a cylindrical tube, leaving an annular space between it and the wick tube, in which is crowded the wicking, to prevent the fire from running down into the body of the lamp. The cylindrical tube has an aperture at its lower end for the reception of a right-angled tube connecting with the magnesium reservoir and air-compressing apparatus, and a gas and air supply tube is inserted in its other side. The top of the cylindrical tube is provided with a removable nozzle, shaped according to the form it is desired to give to the magnesium illuminating flame. There is also a flame-erector supported a short distance above the wick-tube, consisting of a hollow cone or ring with legs resting on the lower collar of the wick-tube, and a horizontal reflector is clamped between the collar of the wick-tube and the collar of the lamp body. The air forcing and compressing apparatus consists of two elastic bulbs connected by a tube, there being an outlet valve near the first bulb, whereby air may be kept under pressure in the second bulb, in the tube beyond which is also a stop-cock. This tube is also fitted with a pinch-cock and a resistance section. The magnesium powder re-

BROOKLYN'S TRIUMPHAL ARCH.

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ceptacle may consist of a magazine held on the right-angled tube extending out on the right of the lamp, or a suitable reservoir may be formed on the upward curved portion of the tube, where it is connected with the flexible tube. In either case, when the magazine is filled with powder, a discharge of air from one of the bulbs will carry forward to the igniting flame as much magnesium powder as lies in the tube below the magazine, a new charge of magnesium falling into the tube as soon as the air pressure becomes normal.

A modified and simpler form of the instrument is also made, which is very serviceable.

For further particulars with reference to this invention address Messrs. Charles T. White & Son, 134 Pearl Street, New York City.

The Forth Bridge.

The practical completion of the great bridge over the Firth of Forth was effected on Thursday, November 7, when the interesting operation of joining in the center the girder which forms the connecting link between the Inchgarvie and North Queens Ferry cantilevers was successfully accomplished. The Glasgow *Weekly Mail* says:

"It was fully anticipated that the connection would have been made on Wednesday afternoon. At 3 o'clock there was only three-eighths of an inch between the bolt holes, and the engineers had everything prepared to close the lower members of the girder, but unfortunately the temporary plates on which rested the hydraulic jacks by means of which the two sections of the girder were to have been drawn together, showed indications of insufficient strength, and the operation had to be postponed until Thursday. It was predicted on Wednesday that the connection would be made at 3 o'clock on the following day. At 7 o'clock in the morning, however, the weather—temperature 58°—was such that the two sections of the girder expanded until there was only a distanee of three-sixteenths of an inch between the bolt holes, and it need hardly be said that the managers on the north end of the girder took full advantage of the favorable opportunity thus presented of forming a connection. This, it may be explained, was effected by means of five plates seven-eighths of an inch in thickness, 8 inches wide, and 10 feet in length, for each side, one going outside, three in the trough of the girder, and one on the inner side. Holes to admit bolts 1⅞ inches diameter were drilled in the girders and plates, the latter of which were adjusted in relation to the known capacity of expansion and contraction of the girder. Twenty-three bolts were needed to keep the plates together, with only three-sixteenths of an inch between the bolt holes. It was, of course, necessary to revert to the use of the hydraulic jacks, and as soon as the holes came opposite each other, a drift or wedge-shaped bolt was driven home on each side of the girder. No sooner were the plates and girders fairly in the required position than the drifts were withdrawn and the large 1⅞ inch screw bolts were inserted and the several layers of metal bound firmly together.

STATUE GIVING A DOUBLE IMAGE.

At the Italian exhibition in the Champ de Mars there was a statue that attracted much attention from the visitors. It represented Goethe's Marguerite standing before a mirror. This latter gave by reflection the

STATUE GIVING A DOUBLE IMAGE.

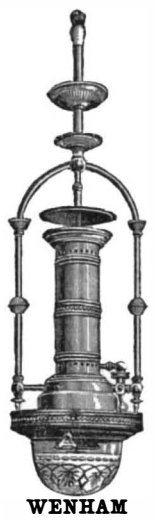
image of Faust, as shown in our engraving. The artifice was well concealed by the sculptor. In reality, it was not a double statue, but the figure of Faust was skillfully obtained by means of the folds of Marguerite's robe.

Marguerite holds her arms in front of her, and these same arms form those of Faust, who holds them crossed behind his back. Faust's face is carved in Marguerite's back hair, and the man's figure is obtained, as before stated, by means of the folds of the woman's robe. This curious object might inspire some of our sculptors with an analogous idea. We do not know the name of the author of the statue, but we can say that it was exhibited by Mr. Francesco Toso, a Venetian manufacturer of mirrors.

The statue was of wood, and of nearly life size.—*La Nature.*

THE WENHAM GAS LAMP.

For several months the Wenham gas lamp has been in use in the office of the SCIENTIFIC AMERICAN. Our many visitors have noticed it maintaining what at a distance seems to be a globe of flame, which burns without change or flicker. They are overhead lamps, and nothing but a transparent hemisphere of glass intervenes between the light and the air below, the illumination being extremely brilliant. The mass of flame is in shape like an inverted umbrella or mushroom, and is about six inches in diameter.



WENHAM GAS LAMP.

The lamp marks an epoch in the art of gas lighting. Years ago Bowditch pointed out the fact that by superheating the air consumed by a gas flame its illuminating power would be increased. The Siemens regenerative furnace, by heating both fuel and air before combustion, practically increased the calorific power of fuel. In the Wenham lamp these principles are utilized. The gas enters at the top of the fixture and travels downward through the center. The pipe through which it passes is surrounded by the products of combustion from the flame, and the gas becomes intensely heated. Part of the air enters above the flame, and, also passing downward, is in like manner heated. Issuing from radial jets, the gas meets the hot air and burns with an intense white light.

To prevent the annoyance of lowering the glass globe, a small watch light is provided and a stopcock operated by wire or chain is attached to the lamp. By simply pulling one or the other chain, the gas is turned on and lighted or is extinguished.

Different sizes are provided, and a remarkable economy in gas is effected. Over twelve candles per cubic foot of gas per hour is realized with ordinary gas. The common burner gives but half this quantity, indicating a saving of fifty per cent. The appearance of the burner is highly ornamental, it casts little or no shadow, and speaking from experience, we can say it is a practical success. It is supplied from 50 to 250 candle power, and over 100,000 have been sold here and in Europe.

The United Gas Lamp Company, 825 Broadway, New York, are the proprietors of this lamp, as well as of the Lungren, Gordon, and other burners of the advanced type. By more than doubling the illuminating power of gas, a formidable rival to electricity as a lighting agent would seem to be created. Gas lighting at any rate is kept well in the front of the field, and we believe that there will now be room for both gas and electricity for many years to come.

Francis M. Roots.

Still another gap in the ranks has been caused by the death, on October 25, at his house in Connersville, Ind., of Mr. Francis M. Roots, whose inventions in certain mechanical lines have made his name world-famous. Prominent among these inventions are the principles of the rotary exhausting and blower systems that bear his name. The following special press dispatch, bearing date of October 25, is all that we have at present respecting his decease:

Francis M. Roots, a well known philanthropist, banker, and inventor, died at his home in Connersville, Ind., October 25, after a long illness. He was taken seriously ill in London, England, about four weeks ago, but rallied after arriving in New York. When he reached home it was thought he would recover, but a serious relapse terminated all hope. Deceased was born in Oxford, O., on October 28, 1824, and was the son of a well-to-do farmer. He received his education in the Miami University, and moved to Connersville, in 1845, to establish a large woolen mill business, which, in connection with his brother, he conducted until about 1859, when he disposed of his interest and entered upon his career as an inventor. In 1860 he perfected the invention of the rotary blower, which is now in use at the Capitol, Washington, D. C., and in every Western Union office of any size in the United States. It is also extensively manufactured in Europe, Mr. Roots having large business interests in England and on the Continent. He was also the inventor and manufacturer of Roots' gas exhauster—known to the gas industry of the world—and Roots' steam pump. He did not confine himself solely to the manufacture of his inventions, being president of the First National Bank of Connersville, of the Connersville Furniture Company, and in several other branches of business in Connersville and Cincinnati as well. He was a leading member of the First Presbyterian Church, and widely known for his charity, having given largely to the Western Female Seminary, at Oxford, of which institution he was a trustee at the time of his death. He leaves a wife and three children—Daniel T. Roots and Mrs. Dwight Johnson, of Connersville, and Mrs. Edwin Schively, of Philadelphia.

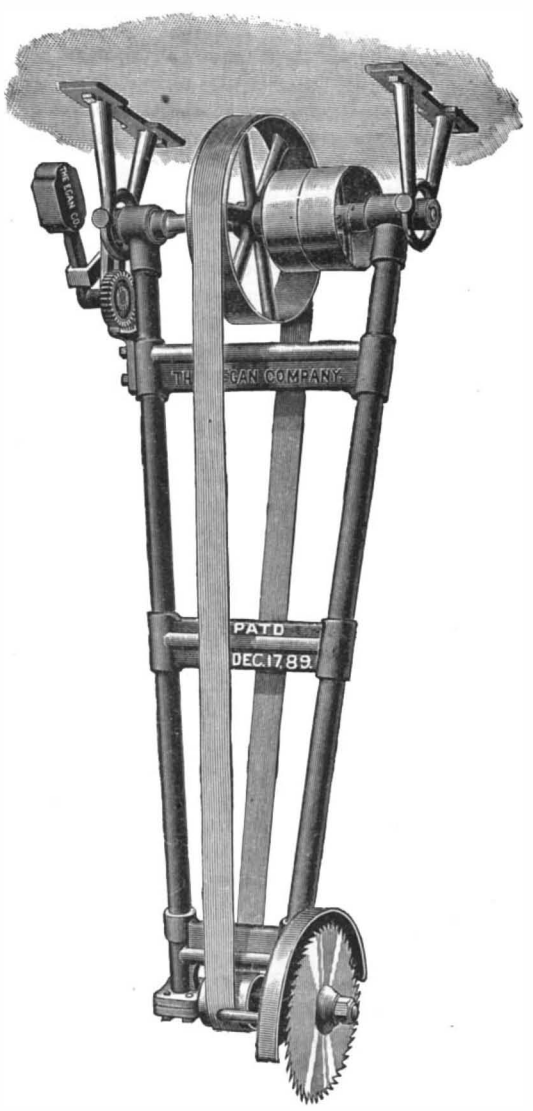
The Rotary Snow Plow in New Mexico.

The use of the Colorado Midland's rotary snow shovel on the Denver, Texas, and Fort Worth seems to have created a mild sensation. A local paper says: "It was put to work in a big cut where the snow was about 20 feet deep and made excellent headway, throwing an avalanche of snow 50 feet into the air at every revolution of the great plow, which literally bored itself through a mass as compact as sand. When about the center of the cut, a strange sight was witnessed. Those who were standing on either side of the plow were suddenly deluged with a shower of beef steaks. On all sides fell porterhouse, sirloin, round steaks, small steaks, shoulder steaks, with occasionally a slice of liver or a nicely cut rib roast. It was thought at first that the engine had left the track and was boring its way through a butcher shop. Investigation, however, disclosed the fact that a herd of Texas cattle had crowded into the cut and had frozen and been buried in the drifts. Manager Meek immediately declared that no well regulated road should be without a rotary snow plow."

NEW SWING CUT-OFF SAW.

We illustrate herewith a new swing cut-off saw recently patented by the Egan Company. This is one of the latest patents on a swing saw, and it will be found to materially improve this class of machine.

The new feature of this swing saw is that the improved self-adjusting compensating or balance weight keeps the pendulum or frame normally tilted back out



THE SWING CUT-OFF SAW.

of the way of the operator, and in coming forward it adjusts itself to the movement of the frame and helps the operator in bringing it forward, as well as taking it back completely out of his way. A practical man will appreciate this point on a swing saw.

It also makes this class of machine much better and much quicker to handle and also much more accurate. These will be found great points to commend the machine to all woodworkers.

The machine possesses the latest improvements, and is thoroughly tested and tried by the manufacturers before shipping. For a more complete description write the manufacturers, 261 to 281 W. Front Street, Cincinnati, O.

The machine is made with wrought iron frame for light work and cast frame for heavy cutting off.

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Correspondence.

Gas Generated in Ammoniacal Ice Machines.

To the Editor of the Scientific American:

Referring to the "Unknown Gas" article on page 338 of your issue of November 30, 1889, I would say that I analyzed a sample of this gas October 21, with the following result:

Oxygen by volume	7·4 per cent.
Hydrogen by volume	72·0 "
Nitrogen by volume	20·6 "

The color of the flame is yellow, tinged with green, the yellow tint being due to traces of sodium, the green to the ammonia present.

The above sample was taken from a new machine, from which I do not think the air was fully expelled. The gas is principally hydrogen, as shown, and is due, I think, to the decomposition, under the varying pressure and temperature, of the ammonia itself.

C. F. ZEEK, Supt., Pensacola Gas Company.

Pensacola, Fla., December 3, 1889.

[The above analysis is of much interest, and carries out the conclusions expressed in our note upon the original communication.—ED.]

A New Filtering Medium.

At a recent meeting of the Engineers' Club of Philadelphia, Mr. Wm. B. Spence exhibited a working model of the Rimmer oxidizer, a filtering material, which he described, and for which he made various claims as to its utility in the purification of water by oxidation. He stated that the material used is an English invention and that it is known as magnetic carbide of iron. It consists of a mixture of granulated iron ore and carbon. The iron ore is said to be cleaned of all natural impurities by a patented process. It is then chemically treated at a certain temperature. It is claimed that this material will absorb and retain a large quantity of oxygen from the atmosphere. In use it is charged daily with atmospheric air, when, it is claimed, a reaction takes place with the impurities which have accumulated in the filtering material, and that the result passes off in the form of gas. It is claimed that metals in solution in the water will form insoluble oxides. The upper layer of the filtering plant consists of sand, for the removal of suspended matter by mechanical filtration, and the lower layer of the material above described, for the chemical removal of impurities in solution. It is claimed that both vegetable and animal organic impurities and metallic contaminations are entirely removed by this process. The following tests were made in the presence of the meeting:

The filtering materials were contained in a large glass funnel. Water, as muddy as that of the Schuylkill River during freshets, was made apparently perfectly clear. A solution of sulphate of iron in water was made and a portion thereof passed through the filter. The unfiltered and filtered portions were then tested with ferrocyanide of potassium. The former showed a distinct blue tint, while the latter remained perfectly clear, showing the elimination of the iron. Lead and copper tests seemed to show the same results. To illustrate the destruction of organic matter, sulphide of ammonia, sulphide of iron, and acetate of lead were added to water, making a compound which was almost black and of strong and unpleasant odor. After filtration it was clear, and tests seemed to fail to discover any trace of the impurities. A mixture of copying ink and water was passed through the filter with the same results.

A New Treatment and Possible Cure for Cancer.

The anonymous correspondent of the *Lancet*, whose suggestion of the combined use of papain and thallin in cancer was noticed in a recent number of the *London Medical Recorder*, turns out to be Dr. J. Mortimer Granville. He has since supplemented his first statement by a further communication, in which he says that if the solvent or digestive power of the papain is to be brought to bear on the morbid growth, it must not be exhausted by being first mixed with food. He therefore recommends *very frequent* administration of the papain and thallin and their combination in the form of pills. The aim is to get absorption of the drug, not local action on the stomach. In cancer of that organ, Dr. Mortimer Granville gives, besides the pills, papain suspended in water with thallin and an alkali. With the view of further preventing exhaustion of the papain, he directs that the patient shall be fed as exclusively as possible on a vegetable diet, and that the pills shall be taken before meals or in the interval between them. He has not found that the thallin given as described exerts any injuriously depressing effect on the organism as a whole. The vitality of the morbid growth *seems* (the italics are Dr. Mortimer Granville's) to be depressed by saturation with the thallin and papain locally; this is effected by applying a strong paste of the two drugs in combination, or, where practicable, by their inunction. The results obtained so far are said to be encouraging, and "make it clear that the method will deserve a full and fair trial by the profession."—*London Medical Recorder, August* 20, 1889.

Rest and Exercise in Heart Disease.

In the treatment of more than one disease there has always been a conflict between those who advocate rest and those who advocate exercise as a remedial agent. The fact is, these differences are more apt to occur on paper, where inferences are hastily drawn from a few cases. More than five years ago Oertel published, in *Ziemssen's Handbuch der Allgemeinen Therapie*, his *Therapie der Allgemeinen Kreislaufstörungen*, in which he advocated for certain forms of functional heart trouble, not rest, but active exercise, such as mountain climbing. Before him Stokes, of Dublin, had noticed that heart cases did well in climbing the Alps. In prescribing mountain climbing the utmost care is necessary, as the distance to be covered should be regulated for each patient. Its object is to strengthen the heart muscle and promote the circulation. As only healthy arteries can stand the strain, such treatment is, of course, contra-indicated in atheroma.

Loomis (*Medical News*, November 9, 1889) has reviewed this subject and given his experience with it. In the early history of physical diagnosis the detection of a heart murmur was always looked upon as a grave event, and even now many clinicians hearing a systolic apex murmur forthwith pronounce the diagnosis "mitral regurgitation" without sufficiently considering the other signs and symptoms. Such cases often do well with exercise and out-door life. In fatty degeneration the heart in a young person can stand a moderate amount of exercise and can undoubtedly be strengthened, but it is in fatty infiltration or fatty overgrowth that the judicious use of exercise does great good. In this case the general diet should be regulated and the general obesity which usually exists should be removed by a depleting diet. Some German physicians in their city practice recommend stair climbing when mountain climbing is not feasible. It is undoubtedly a fact that cardiac exercise of this kind has proved of benefit to patients in Germany, and there is no reason why it should not be used in the same way in America. Those patients under forty without hypertrophy, and with other organs intact, often recover entirely or at least improve greatly while the murmur still continues, affording them little or no inconvenience.—*Maryland Medical Journal.*

Somnal.

"Somnal" is the suggestive name applied to what is described as "ethylirtes chloralurethan," represented by the formula $C_7H_{12}Cl_3O_3N$ (*Phar. Zeit.*, October 5, p. 611). It was at first described as being prepared from chloral, alcohol, and urethan, and as differing from the compound recently introduced as "chloralurethan" by containing 2C and 4H more in the molecule; also as melting at 42° C., boiling in a vacuum at 145° C., and as not being altered by the addition of silver nitrate or by acids. As the crystals are very deliquescent, the preparation appears to be sent out dissolved in alcohol, in which it is soluble to the extent of three parts in one. The advantage claimed for "somnal" is that when administered in two-grain doeses it induces within half an hour a quiet sleep that lasts from six to eight hours without any inconvenient by-effects. It is not unimportant to add, however, that Herr Lutze, writing to the *Pharmaceutische Zeitung* (Oct. 26, p. 652), has claimed that somnal is none other than chloralurethan under a new name and that the addition of the word "ethylirtes" is simply a blind. This statement has, however, evoked a denial from Herr Radlauer, who now affirms that it is a product of the direct combination of chloral alcoholate and urethan in a vacuum apparatus, and that its composition is correctly represented by the formula:

$$CCl_3—C(OC_2H_5)(H)(NHCOOC_2H_5)$$

Safety Appliances in Railroads.

In his recent message to Congress, President Harrison laid much stress on the need for adopting means for insuring the safety of railroad employes. An annual death list from accidents in service of over 2,000 railroad employes, with ten times the number injured, was cited by him as illustrating the urgent nature of the case. He suggested congressional action, requiring uniformity in the construction of cars used in interstate commerce, and the use of improved safety appliances upon such cars.

The suggestion seems one which should receive immediate attention from Congress. Practically every railroad in the United States falls within the scope, direct or indirect, of federal legislation. All the standard gauge roads forward interstate trains and cars, and it would only be a few narrow gauge roads that would not come within the interstate category. The ingenuity of inventors has been exercised to a wonderful extent upon car couplers. All passenger cars on first class roads have some form of automatic coupling and brakes. The freight cars are still to be provided for. When the engine of a freight train signals for the application of brakes it sometimes has caused the brakemen to jump off the train, fearing a collision. In any case the application by hand is very slow. The use of hand brakes and common couplings on freight cars is the cause of so much of the loss of life alluded to in the President's message that we cannot but anticipate remedial legislation as regards these two vital and fatal parts of railway service and appliances.

CONCAVE CELESTIAL MAPS.

In his lectures at the observatory of the Trocadero, commenced in 1880, Mr. Leon Jaubert substituted concave celestial maps for the convex globes that had formerly been employed. These reproduced as accurately as possible the appearance of the heavens and the apparent diurnal movement of the stars.

These maps are constructed on various scales, some being 3 millimeters to the degree, some 4 millimeters, some 6 millimeters, and some even as large as 12 millimeters to the degree. Mr. Leon Jaubert exhibited at the Palais of Industry in 1887 a section of a sphere that was built on the scale of 6 centimeters to the degree, that is, 21·60 meters in circumference.

Mr. Jaubert has constructed geometrical spheres for astronomical uses in the following manner: 1. In two polar sections of 20° each. 2. In eight zones, each being 20°. 3. Each zone is subdivided into twelve parts by meridians 30° apart, and passing from the 80° north circle to the 80° south circle, thus forming in the eight zones 96 divisions. 4. Each polar section is subdivided equally into two sections by the meridian of the equinoxes, thus making four sections or 100 divisions for the whole sphere—50 for the northern hemisphere and 50 for the southern.

Each division is numbered in rotation, beginning with the north pole and descending to the south pole. The imperfect system of notation of Bayer is replaced by a very simple system, which is much more exact, and enables not only the stars visible to the eye to be observed, but all the stars according to their position, their brilliancy, or the nature of their spectrum. This same system facilitates the marking of certain brilliant portions of the Milky Way, the constellations, and nebulæ. It was easy to indicate the group of the Pleiades photographed by Mr. Henri at the Paris observatory. Instead of the Greek alphabet, Mr. Jaubert makes use of the alphabet usually employed in Europe, having 26 letters, each of which has two forms, the capitals and small letters. He has added to this four marks.

He uses a mark to indicate the magnitude of the star which enables him to indicate all the stars, whether visible or invisible to the naked eye. The stars are also classified according to their brilliancy. Stars of the first magnitude are marked A, a capital letter being used for the most brilliant and a small letter for the less brilliant. Stars of the second magnitude are marked B, a capital for the most brilliant and a small letter for the less brilliant, and so on down the alphabet. When several stars of the same magnitude are found in the same division, they are marked alike. The most brilliant stars, however, are only marked with the letter that ranks them in their proper magnitude. The next in brilliancy receive besides the letter the numerals 1, 2, 3, 4, etc. If in one section more than 20 stars are found having the same magnitude, this section is subdivided, and the stars of different sizes are classified as in the larger sections.

Mr. Jaubert has also classified the nebulæ according to their general brilliancy. He marks them with a capital or small letter in italics according to size. The letter is single if there is but one nebula in that section. If there are several, however, the latter is followed by numbers as a further distinction. The sections of the nebulæ also can be subdivided according to their brilliancy in the same manner as the stars, as indicated above. The spectrum or chemical constitution of the stars is also indicated. About one-half the stars are either white or blue, and constitute the stars of the first class (in a chemical sense), the yellow stars the second class, the orange-colored stars the third class, and the red stars the fourth. The stars of the first class are indicated by the letter alone and without any mark. The stars of the second type have a horizontal mark over the letter. The third class have a horizontal mark over the middle of the letter; and those of the fourth class the same mark underneath the letter.

The general direction and movement of the stars is indicated by straight or curved arrows.

Stars whose distance and motion are known are marked with a sign which indicates the distance, the speed, and the direction of their path. The fundamental stars, which are noted in the *Connaissance des Temps* and the *Nautical Almanac*, and which are observed especially by astronomers and mariners, are also marked by special signs of their own.

From the above it may be seen that the astronomical maps of Mr. Jaubert contain a number of exact signs distinguishing the different heavenly bodies and which have been applied as a result of astronomical research. These signs are at the same time so simple that they may be read and understood by every one. —*La Nature.*

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THE NEW YORK EXHIBITION OF 1892.

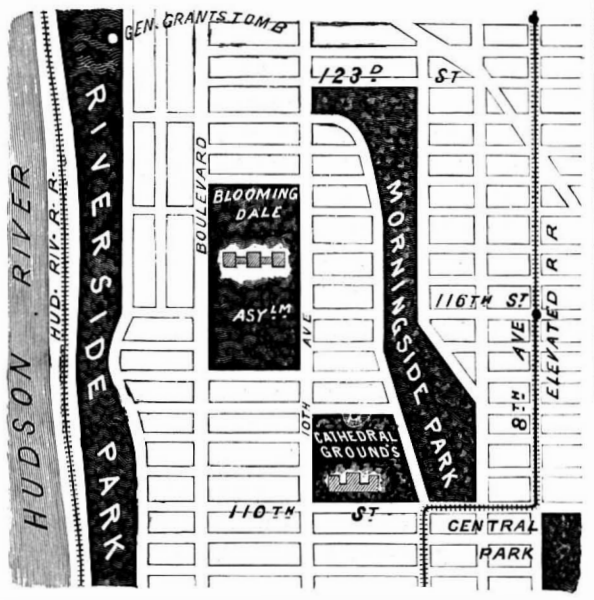
Ever since the guarantee fund for the world's fair of 1892 reached in this city the sum of $5,000,000, there has been shown great interest in the various sites upon which it has been proposed that the fair be held. Various plans have been considered. In our illustrations on this and the front page, we show one of the sites, which for many reasons has been more favored than any other. This includes the tract of land situated at the north end of and communicating with Central Park, and extending from Morningside to Riverside Parks, and bordered on the south by 110th Street. The illustrations give a bird's eye view of the present appearance of this extensive tract of land. The view looking west, as portrayed at the top of the page, embraces in the foreground the level portion of Morningside Park, backed as it reaches the bluff by the heavy embankment wall with massive stone stairways and heavy buttressing bays, with the stately avenue bordering the plateau thus defined. The view in the other picture is taken from the Palisades across the Hudson River, and gives a good idea of the admirable railroad and river facilities that would be afforded by such a site. The tract in the foreground is the Riverside Park, while beyond may be seen the long, narrow strip of verdure which marks the location of the Morningside Park. At the right near the horizon is seen the more extensive expanse of the Central Park.

This portion of the city is so little built up that the expense of acquiring the property will not be very great, in spite of the fact that it is approximately the heart of Manhattan Island. It seems a curious provision that the city should have grown around it, and should have left this tract practically unimproved and, in consequence, so much more desirable for the proposed exposition. The city south of this site is pretty well built up to about 100th Street, while the tract north and east of this locality is a thickly settled city. The proximity of the Elevated Railroad and the New York Central and Hudson River Railroad, shown at the bottom of the lower cut, renders this very accessible to even the most southern portions of New York City, while this is particularly accessible to Harlem. The Hudson River, on the other hand, renders it possible for those residing in New Jersey to reach the fair grounds by water, and without having to pass through the streets of New York.

It is beyond question that it would be impossible to find anywhere else a site presenting so many and such a variety of interesting features. But the difficulties to be encountered in launching so vast an enterprise in so short a time demand the greatest energy and the best skill and hearty co-operation of architects, builders, engineers, and mechanics, as well as unstinted resources in money.

This space, favored by the site committee, so far as is known, embraces also a strip of land about half a mile long and a quarter of a mile or more wide, to the north of Central Park, and extending a little way down on its northeast and northwest corners. This land is almost entirely level.

It was originally intended to include also the northern portion of Central Park within the fair grounds, but this plan has now been definitely excluded, on account of the public opposition to such use of Central Park. The principal argument for thus including a portion of the Park was that our two great museums might be made features of the fair—the Metropolitan Museum of Art and the Museum of Natural History, both situated near the northern end of the Park on its east and west sides. These institutions are now rapidly



PROPOSED SITE OF FAIR.

attaining dimensions and securing an importance from the value of their collections which place them in the front rank among institutions of a similar class, and efforts will be made to greatly enlarge them and add to their attractiveness in anticipation of the fair, of which it is probable that they will now form independent but very important auxiliaries.

It will almost go without the saying that the prime reason for fixing upon the location selected is its convenience of access. Larger spaces might have been had with far less difficulty, where the expense of building and laying out the grounds would have been much lower, but they were too far removed from the heart of the great city and its most populous suburbs, from which must come so large a proportion of the support without which the fair, be it ever so excellent, would be a failure. At the proposed pier, on its western river front, the largest vessels from any part of the world can conveniently unload, and thus direct communication would be established between the fair and Europe, which would prove such an inducement to the foreign exhibitors. Centrally the grounds are intersected by the west side elevated railway system and by horse car routes, while the east side elevated system runs very near the east side of the grounds, together with other horse car routes, and the great Vanderbilt system of railroads has its entrance to New York through a partially sunk four-track road on the eastern border of the grounds. All of the most important lines will, it is altogether probable, provide especial depots in the immediate vicinity of several different entrances to the fair grounds, and it is difficult to conceive of a crowd so great that it will not be easily handled, for the exits and entrances on every hand will be convenient to what are already great thoroughfares for city travel.

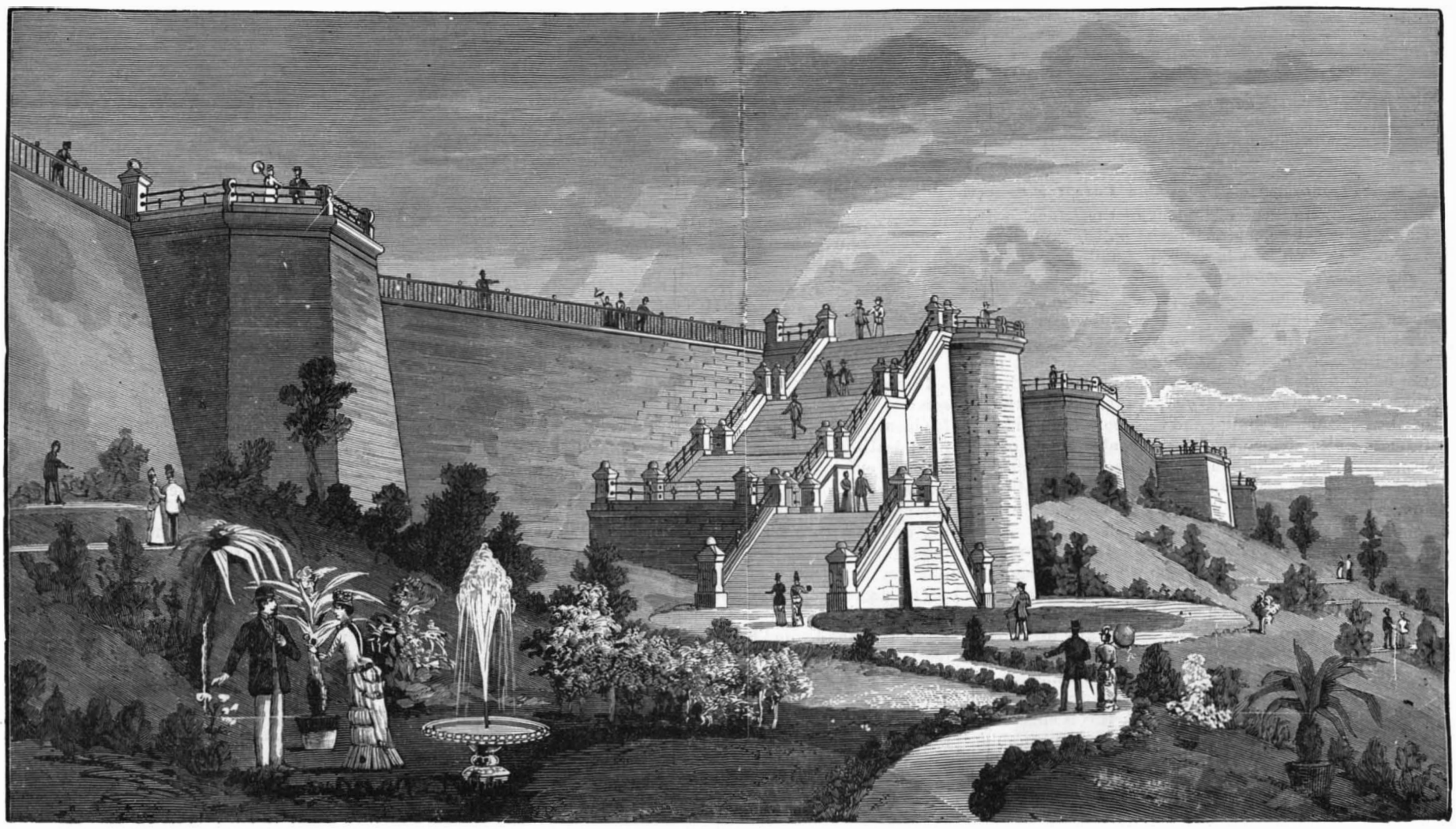
Dispatch in getting the fair definitely started is now the one thing needed—promptness in securing the required national and state legislation, and determining upon the plans for the buildings and the arrangement of the grounds; and with proper energy manifested in these directions, there is no room for doubt that the wealthy and enterprising business men of New York will generously respond to all needful demands, and that the whole country will unite in assisting to make the exhibition one well worthy of the time and the people.

The Cornish Uranium Mine.

It is gratifying to find that a continuous lode of uranium ore—unique in the world—has been met with in the parish of St. Stephen's, Cornwall, about 1½ miles distant from Grampound Road. The lode varies in width from three to five feet, and the uranium ore is not distributed in bunches or pockets, as is the case elsewhere, but is continuous throughout. This valuable metal, worth at present about £2,400 per ton, occurs in the state of uranic phosphate, though hydrated uranous oxide is also to be met with. Samples of the ore seem to have yielded, on the average, 12 per cent of the pure metal, though some samples run up to 30 per cent. The advantageous feature of this deposit of uranium ore, in addition to its continuous character, is its freedom from arsenic and other ordinary impurities, which render the extraction and purification of the metal difficult and costly. Our readers are, of course, aware of the uses of uranium, in giving green and golden colors to glass, in the production of a fine black upon porcelain, and in photography. But if a large and regular supply is available, it may be used in electro-plating and in the formation of gold colored alloys with platinum and copper, the former of which is said to resist acids. This may open the door at once to honest and dishonest arts.—*Chemical News.*

Safety Line Wanted for Vessels.

To carry out the intention of Congress, which requires sea and lake going steam vessels to carry a line projectile apparatus on February 1 next, the supervising inspector-general of steam vessels has invited inventors of such devices to submit working models to the board of supervising inspectors, which meets on Wednesday, January 15, in order that their adaptability for the purpose intended may be determined, and those devices found suitable approved for use.



MORNINGSIDE PARK

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ELECTRIC PHENOMENA PRODUCED BY SOLAR RADIATIONS.

As a consequence of numerous observations made between May, 1885, and July, 1889, I have been enabled to establish the fact that solar radiations are the cause of certain electric phenomena, the study of which is summed up in the following laws:

1. Solar radiations, upon meeting with an insulated conductor (metal or carbon), communicate thereto a positive electric charge.

2. The extent of such charge increases with the intensity of the radiations and decreases with the hygrometric state of the air. At Paris, its value reaches maximum in summer at about one o'clock in the afternoon, when the atmosphere is pure and dry.

3. The passage of clouds near the sun causes the phenomenon to cease.

The experimental arrangement adopted was as follows: A large metallic cylinder, C (see figure), turned toward the sun, was put in communication with the earth, and formed a Faraday's cage. An aperture in the cover permitted the solar rays to enter the cylinder and strike a metallic plate, S, arranged in the center. This plate was of copper and had been carefully insulated upon a Mascart's support. A conducting wire, wound with silk insulated with paraffine, was fixed to the plate, S, and ran to a room below in which were arranged the observation apparatus. These latter were as follows: A Mascart electrometer, E, a 100 element battery, P, a standard Daniell element, D, a graduated scale, G, and a sulphuric acid insulating support, M.

The box, C, the box of the electrometer, E, the center of the battery, P, and the negative plate of the battery, D, were connected at the same point of the earth, whose potential was taken as zero. The electrometer needle was connected with the insulated metallic plate.

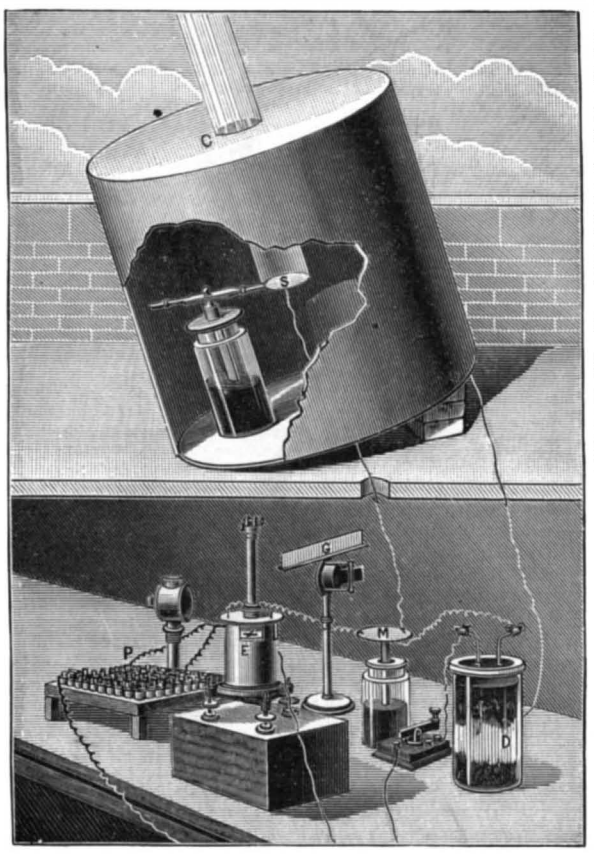
I used in succession the Lippmann electrometer, which had to be abandoned on account of its too great capacity for this kind of experiments, the Hankel electrometer, and the Curie and the Mascart. The following is in what the experiment consisted:

The insulating support, M, to which were fixed the wires communicating respectively with the plate, S, and the electrometer needle, E, were so connected with the ground that the potential of the plate and needle became equal to that of the ground, which was taken as zero. The support was then insulated from the ground, and there was immediately observed upon the scale, G, a deflection of the needle indicating a *positive charge* of the plate, variable with the intensity of the solar radiations and the hygrometric state of the atmosphere.

This deflection was compared with that produced by the Daniell element, D, of which the positive pole was connected with the electrometer needle, and the negative with the earth. Moreover, I had carefully studied, in some preliminary experiments, the influence of the complex phenomena that might vitiate the observations by producing an electric charge independent of that due to solar radiations. In this way I ascertained that by suppressing the Faraday cage, the metallic plate, being exposed to the free air and shade, became charged under the influence of the wind alone.

In the observations, this disturbing cause was carefully eliminated by the use of the metallic box, C, the presence of which prevented the wind from reaching the plate, S.

The other secondary phenomena, such as the heating of the plate, the thermo-electric actions, etc., were found to be of no consequence in the presence of the phenomenon studied. After this study of the phenomenon, let us endeavor to draw some practical conse-



APPARATUS FOR STUDYING ELECTRIC PHENOMENA DUE TO SOLAR RADIATION.

quences from it relative to the electrification of clouds. We must in the first place admit that these results may be extended to non-metallic bodies, such as the clouds. This is a simple though very probable hypothesis, but one that it will be necessary to verify the accuracy of.

When solar radiations traverse a pure and dry atmosphere, they charge the earth that they strike with positive electricity. By analogy with actino-electric phenomena we may admit that the stratum of air immediately in contact with the earth becomes charged with negative electricity. This air, heated in contact with the sun, rises and carries with it its negative charge. This current of ascending air follows an oblique direction in the air under the influence of the wind, and it often happens that, in its ascent, it meets clouds of more or less thickness, that it sustains at a certain height in the atmosphere, and to which it abandons its negative charge.

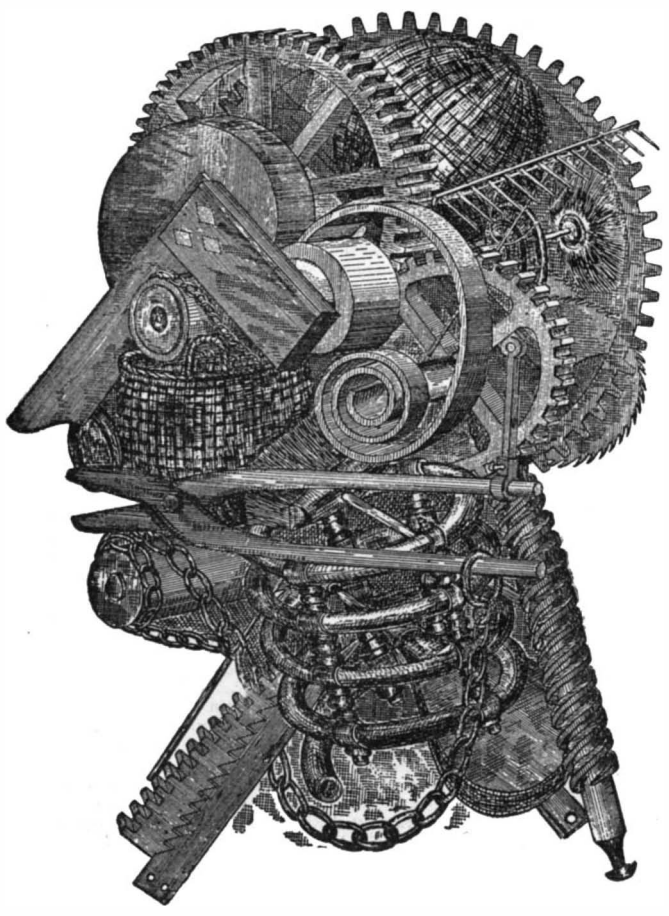
This negative charge continuously increases under the influence of these masses of electrified and incessantly renewed air. This hypothesis would seem to give the explanation of a certain number of storm phenomena. It would appear to explain the negative charge of the majority of clouds. The positive charges that are sometimes observed in clouds may be explained by the supposition of two strata of clouds between which the electric manifestation may take place. Such charge of the clouds should be so much the greater in proportion as the solar rays are intenser and the hygrometric state of the atmosphere feebler. And this is what should especially take place in summer and principally in equatorial regions. This would be explained by the frequency of storms during the hot season and during the summer days in which the solar rays are intense. Herein, too, should be found an explanation of the fierce storms which chiefly prevail in the equatorial regions.

Nocturnal storms would be due to clouds charged with electricity during the day under solar influence, and which would become discharged at night in consequence of the descent of the clouds toward the earth, the explosive distance then becoming sufficiently small to allow the discharge to take place between the cloud and the earth. Such descent of the clouds toward the earth at night is due to the cooling of the ascending currents of air which sustain the clouds in the atmosphere.

We might, in analogous manner explain the frequency of storms over forests, rivers, lakes, etc., as a consequence of the lowering of the temperature of the air above such regions—a lowering that carries with it the descent of the storm cloud toward the earth. Without any desire to expatiate longer upon the hypotheses that might be deduced from the electric phenomena produced by solar radiations, I shall allow myself to express the opinion that it would prove of great interest to follow up the observations made in this new line of researches, in order to ascertain the origin of the electric phenomena of the atmosphere. These meteorological phenomena, whose splendors we have often had occasion to contemplate, offer to all a fascinating subject for study, and, at the same time, are useful to science. Let every one add to such study his own modest quota of observations, and science will soon find itself in a way of knowing the secrets of those great phenomena of the atmosphere which astonish our mind and captivate our imagination.—*Albert Nodon, in La Nature.*

THE INVENTOR'S HEAD.

The accompanying fancy sketch from the *N. W. Mechanic* presents a popular but very erroneous idea of what is supposed to be going on in the brain of a first-class inventor. If the inventor's caput contained anything like the hodge-podge of ideas intended to be suggested by this cut, he would be a pitiable creature, never able to invent or accomplish anything definite or useful. The truth is, the mind of the inventor is rarely fixed upon more than one subject at a time. In order to succeed, he must have a clear intellect and be able to concentrate his thoughts strongly in a single direction. He is generally the most practical-minded man in the world, though, by reason of his power to think a little differently, on new lines, or in advance of the gaping crowds about him, they ignorantly regard him as erratic and wanting in common sense.



THE INVENTOR'S HEAD.

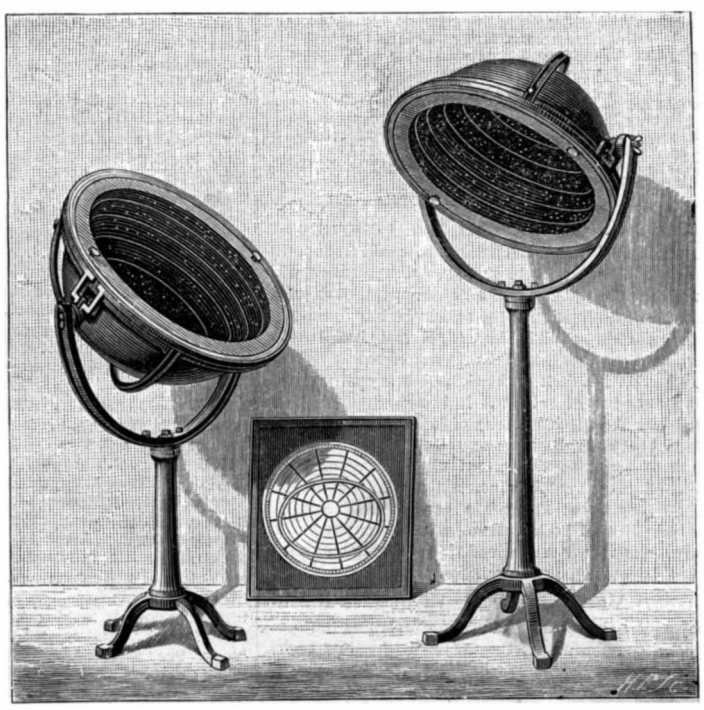
Riches from an Old Mine.

When two men can take out $100,000 in less than a year from a quartz mine, they are doing a pretty good business. Yet this is what two young men, Messrs. Grant and Appel, have done in the Chipps Flat pocket mine, between Moore's Flat, Nevada County, and Allegheny, Sierra County. And they have no mill, either, simply pounding the rich rock up in a mortar by hand.

This mine was abandoned over twenty years ago, and lay idle until these men took hold of it. They ran about twenty feet further in the old tunnel and struck it rich. Since then they have made a number of bullion shipments, the last bar weighing 125 pounds.

Should we read of an occurrence of this sort in a distant region, hundreds of men would be anxious to go to a locality so favored. Yet here it has attracted no special attention. The same may be said of the Bonanza claim, a pocket mine in Tuolumne County, which has yielded very largely of late. In pocket mining there are great chances to be taken, of course, but if the chance is a lucky one, there is great reward for labor. Doubtless many others of the abandoned mines in the older districts of the State will be worked again in course of time, when people come to a realizing sense of their good fortune in living in a region where there are such golden possibilities. Sierra and Tuolumne are not the only mountain counties where there are opportunities for energetic and persevering men in quartz mining —*Min. and Sci. Press.*

COLONEL B. C. BARKLEY, of Charleston, S. C., says that the curlews and seagulls on that coast eat more clams than the entire population of the city. They pick them up, carry them into the air, drop them on the rocks and break them open, then swoop down and feast upon them.



CONCAVE CELESTIAL MAPS.—[For description see page 7.]

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References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.

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Minerals sent for examination should be distinctly marked or labeled.

(1666) J. R. asks (1) the best known means of deodorizing and taking the smell from petroleum oils of any specific gravity. A. Treatment with concentrated sulphuric acid followed by thorough washing and neutralization of the acid is the best means. 2. Also what kind of oil is Lima, O., oil? Is it an inferior petroleum, or does it take that name before it is refined? A. Lima oil is a dark or black and heavy oil, containing a great deal of sulphur. It is a limestone oil. It first showed a specific gravity of 36° B., later wells have reached 37° or 38° B., and one well 41° B. It only gives 50 to 65 per cent deodorized illuminating oil. The large quantity of sulphur increases the expense of refining also, by about 10 cents a barrel. 3. What is the average price of petroleum oil when it is put on the quay fo shipping? A. Refined, 7½ cents gallon upward; crude, about $1.10 per barrel.

(1667) Varley asks: Can you give me the recipe of a harmless mixture for browning the skin, similar to sunburn. A. Use the juice of walnut husks. Or some of the light brown hair dyes may be used with little risk, if they are free from lead. An ammoniacal solution of bismuth followed by a solution of pyrogallic acid may be employed.

(1668) G. asks (1) if fire clay can be burnt into a brick two feet long and six by eight inches at each end with the same degree of hardness throughout. A. Yes. 2. Will frost or freezing cause it to disintegrate? A. Slowly, if at all.

(1669) H. S. writes: 1. I have a bet with a friend that the sal-ammoniac solution has no effect on the zinc or carbon in the Law battery until the circuit is closed. He thinks it has some effect. Who wins the bet? A. Practically it has no action, although, owing to the impinging of the zinc, it is slowly corroded on open circuit. 2. How many glow lamps does it take to light a Pullman palace car? A. About 30. 3. Would a 1 horse power dynamo generate any electricity, and if so, how much, making 300 revolutions per minute? A. The speed of dynamos depends on their construction. A 1 horse power dynamo should generate 746 volt amperes of electric energy. 4. Would a two horse power dynamo generate as much, making 150 revolutions per minute? A. If of the same type it would not. There is for each dynamo a critical speed, above which it rapidly approaches its maximum power.

(1670) H. D. asks: What size Edison incandescent electric lamp can be successfully operated with the dynamo machine described in SUPPLEMENT, No. 161? A. Two four-candle lamps.

(1671) W. M. writes for a good recipe for the making of a good gum mucilage. A. A simple solution of gum arabic in water with a few drops of oil of cloves is excellent. See answer to query 263 for postage stamp mucilage. For regular mucilage substitute water for alcohol, and add a few drops of oil of cloves.

(1672) Ph. G. writes: Would you please let me know a cheap and simple way to make soap on a small scale, to be used for scrubbing, etc.? A. Dissolve 1 pound of caustic soda (sold as concentrated lye or as caustic potash) in one or two pints of water. Let it cool. Melt 6 pounds of grease in a pot and pour into it with constant stirring the soda solution. When thoroughly saponified, pour into pans about an inch deep, and when it solidifies cut into cakes. To improve it you may cut it up after a few days, and remelt it with a little hot water, when the soap will curdle or granulate. The curdy soap is to be lifted out with a perforated skimmer, and washed off and remelted with a little more water if necessary, and cast into pans or moulds.

(1673) E. H. B. says: In the matriculation examination, Harvard Medical School, department of physics, the following question was asked: "Why can't gold, silver and copper coins be cast in a mould?" What is the answer to above question? A. Coins can be cast, and probably were cast in the early ages, in the same manner as combs, hair pins and knives. Chinese and Japanese coins are cast now. The casting of gold, silver, and copper in moulds makes rough surfaces, lacking the beauty and exactness of finish, as in the modern stamping process.

(1674) C. W. M. asks: 1. How can I make plates for a battery out of electric light carbons? A. Saturate one end of each rod with hot paraffine and cast lead around the ends so prepared. Pour the lead as cool as possible. 2. How many revolutions does armature of simple motor make per minute? A. About 2 500.

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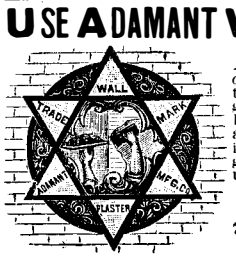

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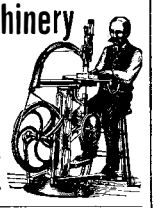

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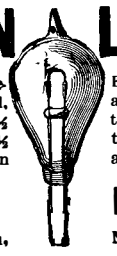

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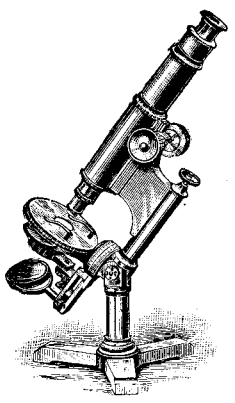

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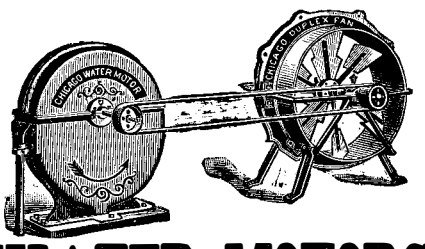

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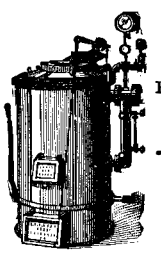

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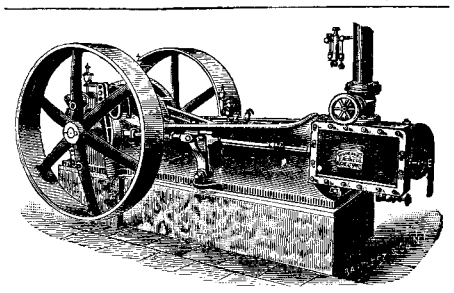

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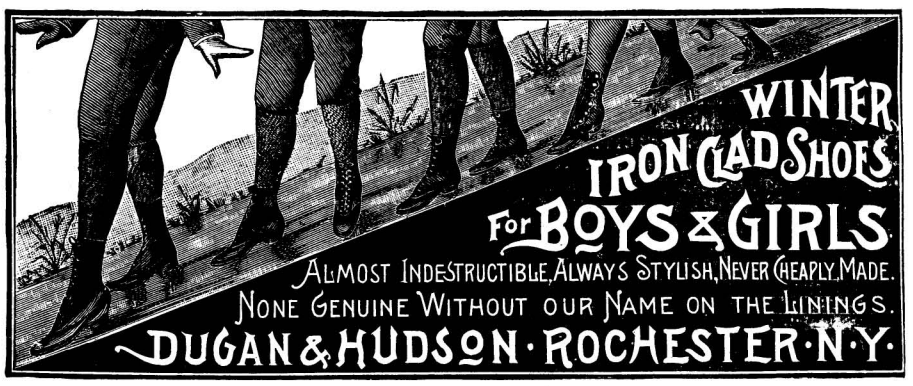
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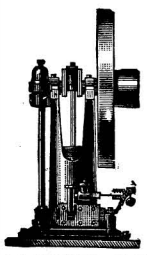

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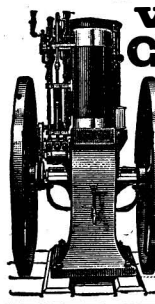

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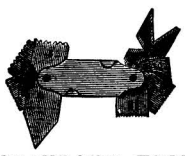

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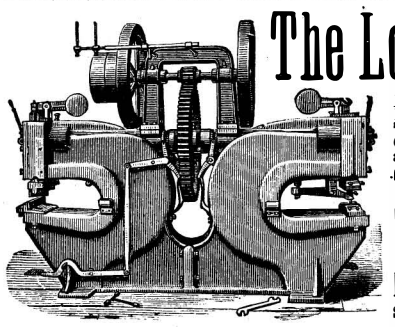

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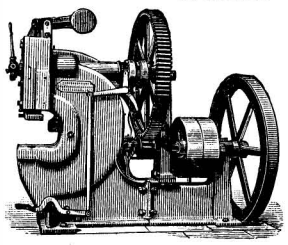

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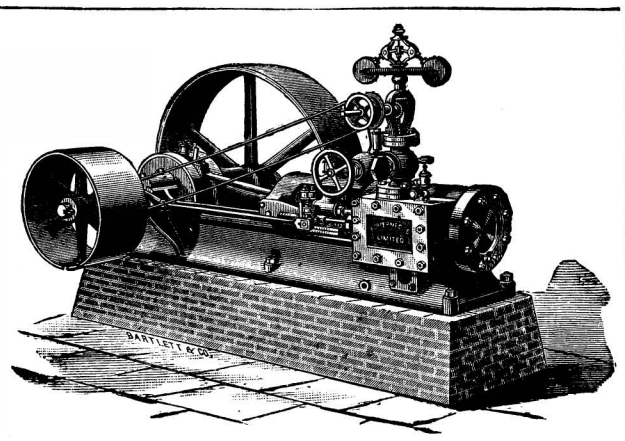

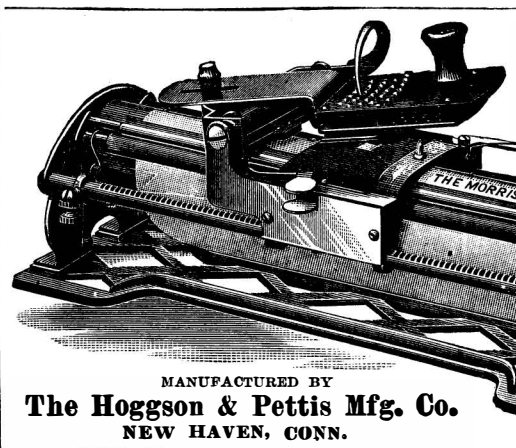

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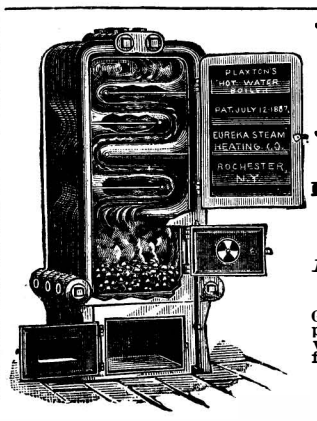

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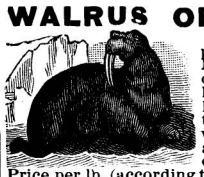

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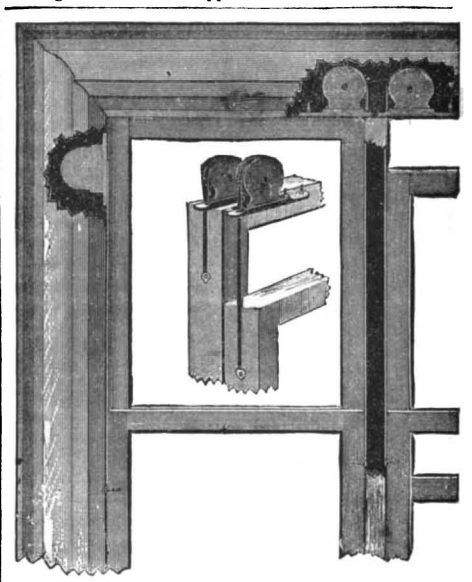

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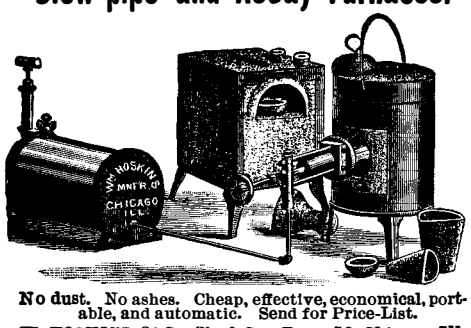

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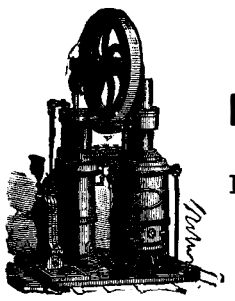

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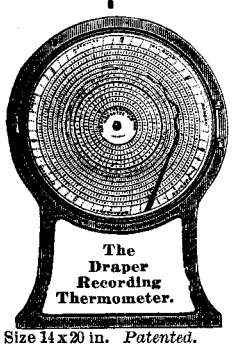

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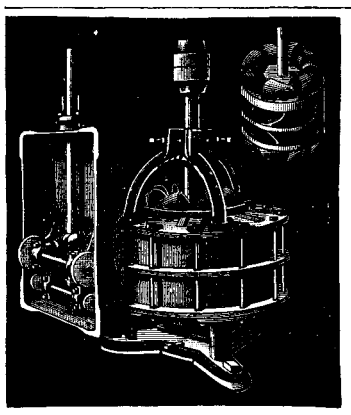

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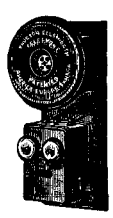

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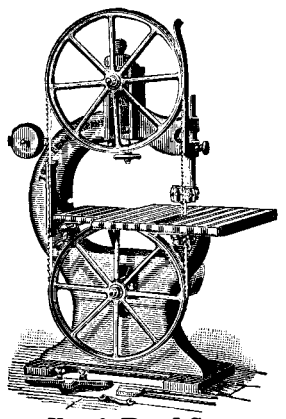

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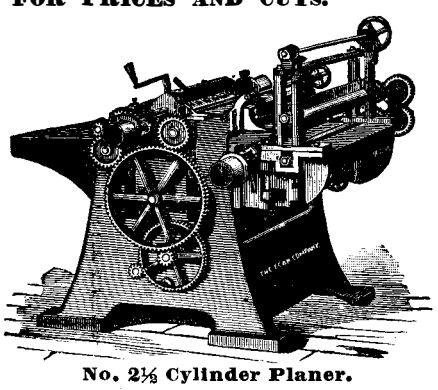

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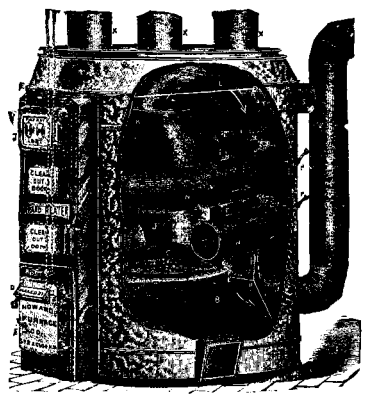

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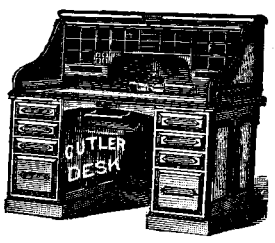

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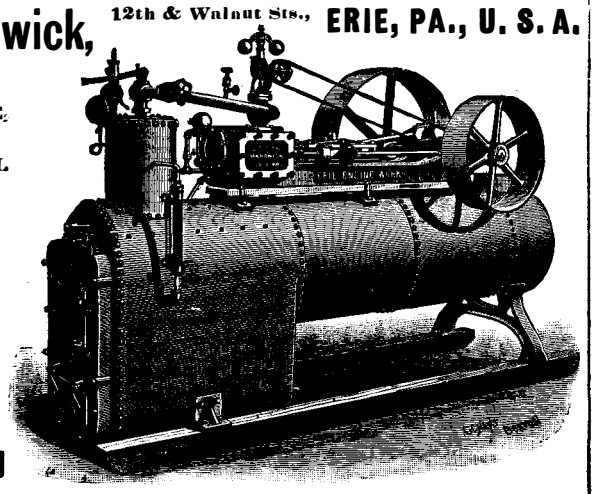

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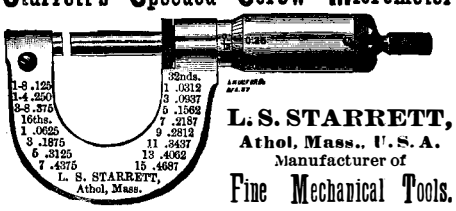

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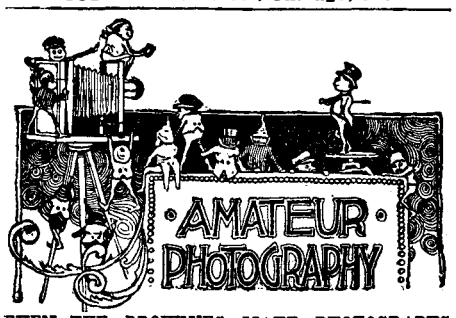

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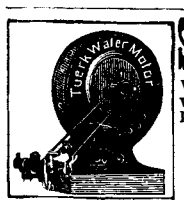

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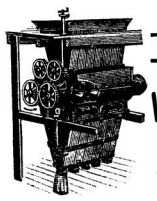

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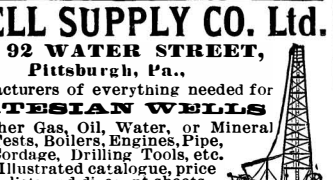

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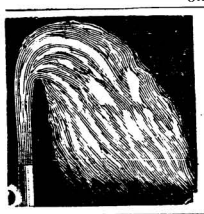

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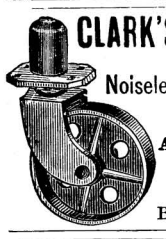

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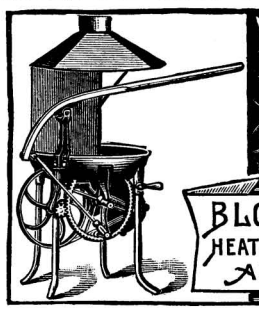

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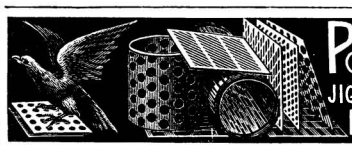

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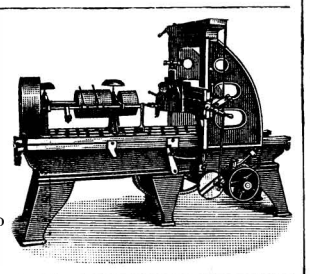

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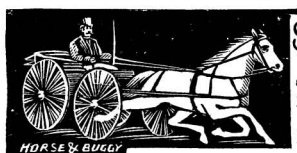

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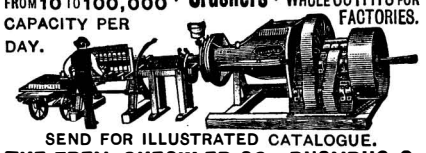

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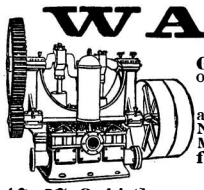

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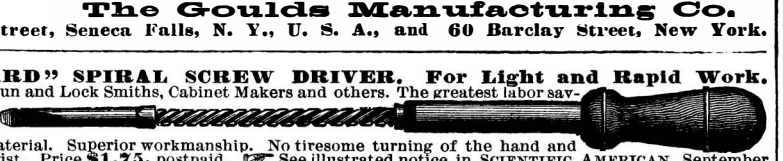

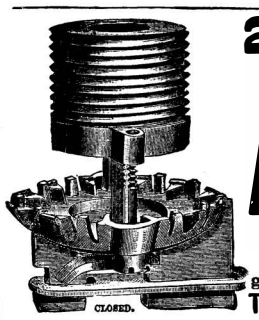

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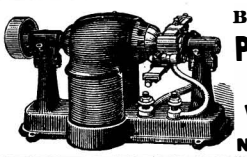

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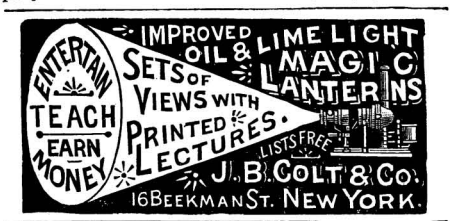

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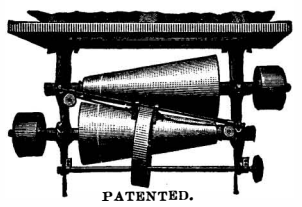

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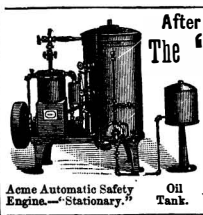

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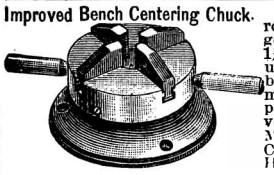

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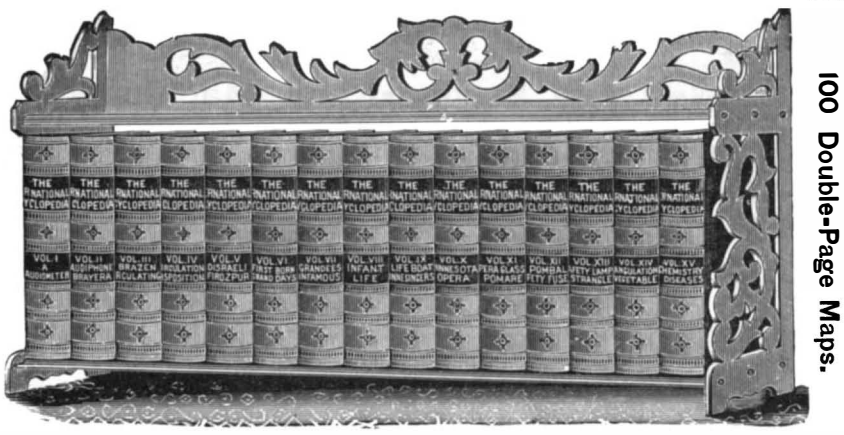

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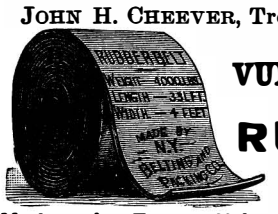

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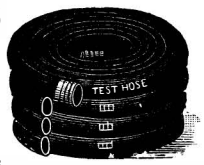

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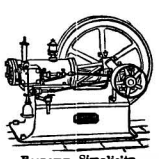
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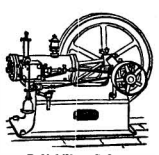
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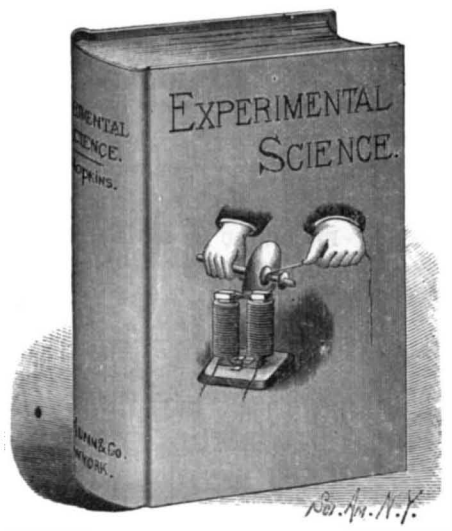

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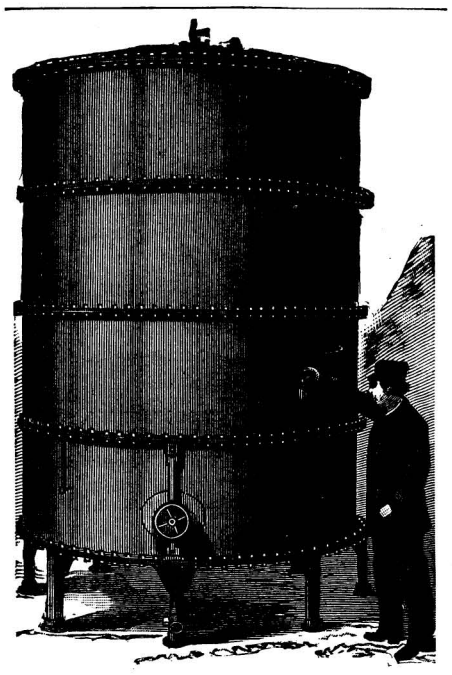

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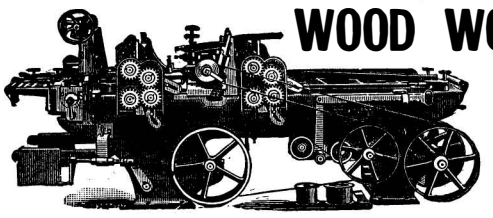

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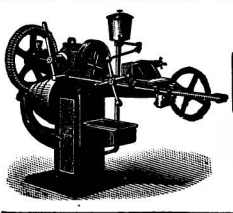

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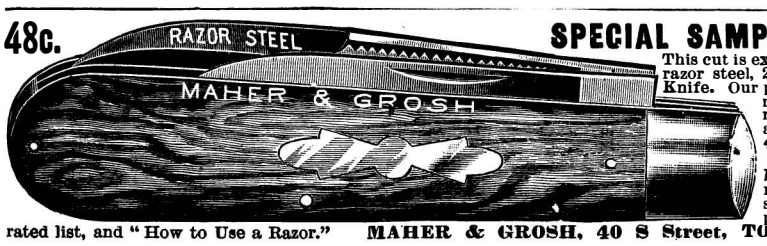

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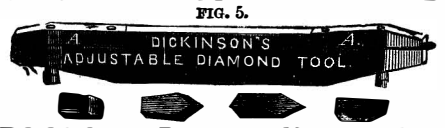

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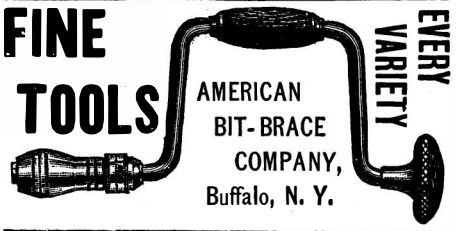

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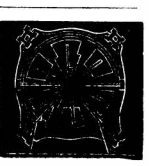

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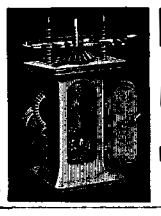

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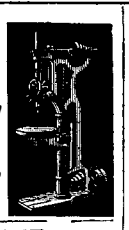

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to every reader of this advertisement who will cut out of any paper in the United States, and send to the address below, the advertisement of any illustrated paper or magazine containing so much high-class matter for so little money as the following advertisement of the New York Ledger for 1890 announces :

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SERIAL STORIES BEAUTIFULLY ILLUSTRATED. Continued stories will be contributed by such wholesome and captivating authors as **Frances Hodgson Burnett, Anna Katharine Green, Elizabeth Stuart Phelps, Robert Louis Stevenson, Col. Thomas W. Knox, Albion W. Tourgee, Prof. W. C. Kitchin, Robert Grant, Frank H. Converse, Harold Frederic, and others.**

CONTINUED ARTICLES. These articles were written especially for the "Ledger" by writers whose reputation and capability establish them as the persons most eminently fitted to treat that particular subject assigned to each.—**The Hon. George Bancroft** contributes three articles on **The Battle of Lake Erie**, beautifully illustrated.—**Hon. Henry W. Grady** furnishes six articles on **The Wonderful Development of the New South.**—**James Parton** contributes a series of articles on **Incidents in the Life of Andrew Jackson.**—**Rev. John R. Paxton, D. D.**, contributes six articles on **Experience in My Army Life.**

POPULAR INFORMATION. Throughout the year the "Ledger" will contain hundreds of sketches of popular information which will supply an amount of beneficial information that will be of inestimable value to those who are in search of something instructive and useful.—**Prof. J. H. Comstock**, of Cornell University, will contribute a series of six useful papers on the study of insects. Prof. Comstock treats of bugs that are useful to the agriculturist, as well as those that are destructive. He points out in the clearest scientific way how to destroy the pests of our fields.—**Prof. Alexander M. Stevens** will explain the manners and customs of the Moki Pueblos, a peculiarly strange tribe of Arizona Indians.—**Dr. Felix L. Oswald** is, by special arrangement, contributing a series of popular scientific sketches, embracing the observations of the writer during his investigations into the unfamiliar phenomena of natural history and occult science.—**C. F. Holder** contributes an extended series of articles on singular aspects of animal life on sea and land. His articles are brimful of information.

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IMPRESSIVE PAPERS. These papers are a medium through which the readers of the "Ledger" will be entertained by many of the most eminent men of the day. The benefit derived from these articles will in itself compensate any one for the price of the "Ledger."—**Mu at Halstead** contributes a series of papers on **The Journeyings of a Journalist**, being the experience of the author during his travels Around the Globe.—**Rev. Dr. McCosh**, ex-President of Princeton College, furnishes a series of papers on the present state of religious thought and development, entitled **On the Border Land of Religion.**—**Hon. George Bancroft** tells of **A Day Spent With Lord Byron.**—**Prof. Eliot Blauvelt** explains how Egypt fell into a state of ruinous distraction, consequent on the decline of the Roman government, and how every species of barbaric rudeness superseded the refined habits of the people.—**Rev. Dr. Henry M. Field** contributes a paper on **The Lopez Expedition**, the first of a series of articles descriptive of thrilling historical episodes.—Many other highly impressive papers are in preparation by **M. W. Hazeltine, E. L. Godkin, Rev. Dr. John Hall, James Parton, Prof. W. C. Kitchin, Rev. Emory J. Haynes, and George Frederic Parsons.**

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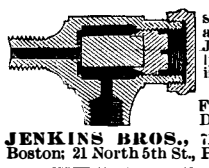

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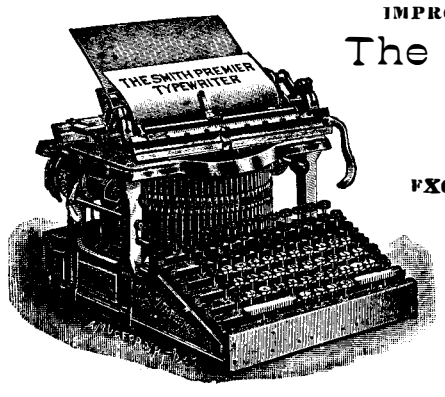

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